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SOME PROBLEMS IN MYCOLOGICAL TAXONOMY *

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Recently comments have been published concerning the status of taxonomy and the inadequacy of the financial support given to taxonomic research. Let us accept, as a generalization, that neither the status nor the support is ideal. One may then examine the condition of taxonomy and ascertain its points of virtue as well as its failures. Such an examination should enable us to direct our research toward improvement in the mycological taxonomy of the future.

Perhaps we should first employ the concept of systematic mycology. According to Swingle, systematic botany, and it applies to mycology, is that phase of botanical science which treats of the naming and classifying of plants. "Nomenclature deals with names, which may or may not indicate relationships. Taxonomy seeks to group plants on a basis of their similarities and differences, these being, as we now believe, expressions of actual phylogenetic relationships. We might conceivably have names without classification, but we can scarcely have classification without names." To all intents and purposes, then, nomenclature and taxonomy cannot be divorced and the problems of one affect those of the other.

Grouping according to relationships carries downward successively through the major categories to the least, the species, or,

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with present knowledge, to specialization within a species. Differences and similarities must be considered and weighed within species if species are to be based on morphology. The problems encountered at the species level may be as important and perplexing as those encountered at the generic level and probably cause more trouble in nomenclature. It is evident that an adequate classification can result only after the problems are solved for all categories.

A perfect classification is the desired end-product and continued effort should be directed toward that Utopian goal. But let us be both idealistic and practical, striving for a proper balance between the two. Irrespective of the pleasure which a taxonomist may derive from discovering a new species, splitting an established genus, seeking in the literature for the oldest valid name, or devising a system of genera or of families, he should not lose sight of the fact that his primary obligation is to be of service to his own branch of science and to allied sciences in need of his research product. Mycological taxonomy is not, and should not be looked upon as, an isolated science. If this branch of science is to reach or maintain its proper relationship to botanical science as a whole, or to mycology in the broad sense, the practical aspects of classification cannot be ignored. The serviceable products of taxonomic research are classifications which make it possible to gain a conception of the relationships of organisms, to permit reasonably ready identification, to give geographical distribution and host or substrate range, and to serve as a source of information concerning the important literature related to the organisms treated.

Mycological taxonomists cannot be accused of being non-productive, but we may be, in some degree, criticized for the lack of serviceability of our products. Too many of us have been more or less content to multiply the number of named species, genera, etc. We have probably been too zealous in seeking for and emphasizing differences in the fungi we study as opposed to finding and pointing out similarities. Although taxonomists have been accused of describing new, or supposedly new, entities for the pleasure of seeing their own names engraved in the archives of history, I question whether this is a particularly valid criticism. Unless his work is sound, anyone who persists in this practice soon finds that this engraved record is as likely to discredit as it is to credit his

name. In the developmental stages of mycology it was necessary to name fungi and perhaps natural and desirable to emphasize differences, because classification is impossible without a fairly large and varied accumulation of named fungi. It may be argued that the present accumulation is still insufficient, but I doubt if many would support such an argument with respect to most groups of fungi. While continued naming and accumulation is necessary this is no longer the primary problem.

It can be argued with justification that a finished classification within any of the taxonomic categories is not now possible and will not be possible in the foreseeable future. This is not, however, a matter of major concern and certainly is no valid argument against accomplishing what is possible with the material and information now available. The need to bring more order into mycological classification as rapidly as possible is imperative.

There are few non-taxonomic workers whose research deals with fungi who do not deplore the time required to learn the identity and the previously published record of the fungus with which they are concerned. Being associated with plant pathologists I find that pathologists are primarily interested in pathological problems. The present status of taxonomic literature causes them to spend unproductive hours, insofar as their research is concerned, searching the literature for the identity, near relatives, geographical distribution, and reported host range of the parasitic fungi. It is safe to assume that this situation also prevails in other fields of science where fungi are encountered. Even those whose primary interest may be in the taxonomy of fungi are not exempt from similar expenditure of time that could otherwise be more productive. It is necesssary to exercise care or one becomes so involved in maintaining indexes of published records that actual taxonomic study suffers. The tail soon wags the dog.

One remedy for the present condition of systematic mycology is for taxonomists to divert their energies to and place major emphasis upon research that results in monographic treatments. Such research has many ramifications and cannot be completed overnight. On the other hand I believe it is a mistake to proceed on the assumption that insufficient information is available or to continue in that attitude of mind which leads to undue delay in publish-

ing the available information. I do not mean to imply that such research is being ignored but rather that the need is great. We can afford to sacrifice some degree of perfection to meet this need more rapidly. Let us establish bases with our present accumulation of knowledge so that future taxonomic work may be both more rapid and more advanced.

In order to produce monographic treatments one must have access to adequate material, especially type specimens, and to the requisite literature. The availability of literature has been increased by the introduction of microfilm. The necessary specimens, including types where they exist, can usually be obtained by loan or exchange. This material is becoming concentrated in the larger herbaria. This, I believe, is desirable but places a considerable responsibility upon such institutions. If large and valuable collections are assembled by an institution they not only must be cared for but should be made available to qualified students. Unless adequate staff is provided this may mean that taxonomists associated with the institution become so involved in routine as to be non-productive in the midst of plenty. The deposition of duplicate type material in such herbaria is becoming standard practice. While it can probably not be made obligatory it would be a commendable practice to refrain from basing species on material which is too inadequate for at least limited distribution. The more troublesome problems revolve about poor descriptions accompanied by either poor or no illustrations and based upon material too inadequate to allow critical re-examination. Monographs are few that do not have a list of doubtful species appended.

The publication of monographs to bring the classification of the fungi up to date and to put it into serviceable form constitutes one of the major problems in mycological taxonomy. Excellent monographs have appeared recently but, considering the number of fungi and the need for such treatments, they are far too few.

Given the necessary specimens and literature the taxonomist should not be content merely to assemble keys, descriptions, and illustrations, although this has frequently been the practice and there is no denying that such works are useful. Real progress in taxonomy requires more than this and can result only when such publications are accompanied by an attempt to evaluate critically

and interrelate the characteristics of the group treated. The individual assigns values to various features and these form the basis upon which he either aggregates or segregates the fungi under consideration. It may be that the individual has a clear conception of the relative phylogenetic significance of the characters which he employs but until the information upon which the concept is based is in print it profits no one but the individual in whose mind it resides. A regrettably large fund of such information goes to the grave annually and must again be accumulated by later workers.

An analysis of the characters used in the classification of the species of a genus or of the genera within a family adds greatly to the value of a classification and if a classification is sound, such an analysis is possible. The value of such analyses should be cumulative.

Here, I would emphasize again that similarities should be as diligently sought as differences. Is it not better to use six subgenera or sections for six closely intergrading groups of species than to segregate into six genera? To segregate emphasizes differences and increases the difficulty of identification, whereas to aggregate such intergrading groups emphasizes their obviously close relationship and increases the ease of identification. The result is a more serviceable and, I think, a taxonomically more sound classification. Questions of nomenclature may dictate the procedure to be followed. For example, *Uromyces* and *Puccinia* differ in only one character, the number of cells in the teliospore. There are numerous species where the spores are predominantly one-celled but because some two-celled spores occur the species is placed in *Puccinia*. There should be only one genus but to merge two large, long-established, and widely known genera would involve endless changes of names. Here we must yield to the practical, even though to do so may not be sound taxonomy.

The need for careful analysis and evaluation of the characters upon which classifications are based constitutes a second major problem in mycological taxonomy.

Many, one might say most, older and many modern descriptions are inadequate. This can be rectified only by critical restudy and redescription of type specimens or, where no type exists, of specimens which approximate authenticity. Such studies should have

been made previously. The amount of the basic materials of taxonomy lost during the war is unknown but must be considerable. These losses do not decrease the need for such work; they rather emphasize the necessity to take appropriate action to prevent recurrence, whether from war, fire, or neglect, and to advance such restudy as rapidly as is possible.

Who would consider, as unnecessarily repetitious, a restudy, redescription, and accurate illustration of the many fungi described by Spegazzini, to cite only one example? I do not know what proportion of Spegazzini's types exists but the existing material is obtainable in most cases. Can we not instigate or encourage cooperative study leading to a more complete and a more rapid restudy of such basic materials? This would involve a planned interchange of specimens and should result in joint or at least co-ordinated publication. The field is large, of course, but planning should result in greater success than the occasional loan of a specimen. To refer again to the Spegazzini collections; I am confident that all of his critical rust species, for example, could be rather rapidly restudied in comparison with other American and probably African species if one cared to undertake such a task co-operatively with Argentine mycologists who have access to this material.

Types cannot continually be reworked without exhausting the material, which frequently is not abundant to begin with. Reexamination should be undertaken with the definite aim of putting into print detailed descriptions, adequate illustrations, and complete notes concerning probable relationships with other named material. Anything less than this will fail to meet the need.

Prior to the war many specimens of flowering plants were photographed in various herbaria of the world. Such photographs may not be equivalent to actual specimens but they are less destructible and can be readily reproduced and widely distributed. Mycologists would do well to attempt a similar program. In the course of my own research I have accumulated several hundred such photographs and other workers have done likewise. Exchange of specimens is a common practice; might we not distribute photographs with equal profit?

Closely related to the need of studying type material and working up monographs is the matter of geographical distribution. Tax-

onomic studies can no longer be considered adequate if limited to restricted areas. Fungi are probably more widely distributed naturally than has been generally realized. This applies both to saprophytes and parasites. In the case of fungi parasitic on economic plants or plants distributed by man, the possibility exists that the parasites may be distributed with the host materials and that both find conditions suitable for survival, or that the parasite is capable of attacking related but native hosts. Numerous examples could be cited. Some of them have proved costly to this country.

If synonyms are not to be further multiplied the taxonomist must become more thoroughly acquainted with the fungi of the world or, at least, of geographically similar regions.

Irrespective of one's particular like or dislike of delving into questions of nomenclature it is true that nomenclature is so intimately integrated with taxonomy that nomenclatural problems must be recognized and the necessary time and effort expended to find satisfactory solutions. The criticism has recently been voiced that nomenclature has not been stabilized because taxonomists have not seriously attempted to achieve stabilization. This criticism may have an element of truth but I doubt that one can infer that taxonomists have not desired stabilization. This is not the trouble. It appears to be, rather, that taxonomists do not agree concerning the best ways to achieve this goal.

Taxonomists set up their own rules, and there can be no objection to this. But having established rules, by majority opinion as voiced in Botanical Congresses, should we not abide by these rules, whether or not we agree, for such period as the rules remain in effect? Such conformity does not prevent anyone from assembling data in support of desirable changes. Until such time as he can convince the majority of the validity of his data, and the desirability of the change in rules which they necessitate, he should swallow his prejudice and conform to the existing rules. Americans, supposed exponents of majority rule, probably sin oftener than most. Consider the relatively minor requirement that descriptions be published in Latin. Do we wholeheartedly follow this requirement? Many do. Those who do not vary from outright refusal to those who meet the letter of the rule by providing a Latin-

ized description so brief that it eliminates two lines of print that might otherwise be put to a useful purpose, but deliberately disregard the intent of the rule and the reasons upon which the rule is based. Or, consider the continual turmoil characteristic of the nomenclature of the rusts that has resulted from nonconformance with the International Rules.

This brief consideration of the problems in mycological taxonomy is by no means complete but has, I hope, touched upon the more urgent ones. To summarize, these problems are:

1. The preparation of monographic treatments of such scope and in such quantity as to place the classification of the fungi in both a sound and a serviceable condition.

2. The need to analyze and evaluate, with published supporting data, the significance of characters employed in the classification of fungi.

3. The critical restudy of the basic materials of taxonomy to obviate, insofar as is possible, the need for continued re-examination or the possibility of the destruction of this material.

4. The need to become adequately acquainted with the fungi of the world rather than with those of restricted areas.

5. The necessity to abide by the International Rules of Nomenclature as they now stand and/or as they may be revised.

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A SURVEY OF THE DISCOMYCETE FLORA OF THE OLYMPIC NATIONAL PARK AND ADJACENT AREAS[1]

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(WITH 35 FIGURES)

This contribution is based upon the collections of Discomycetes obtained from the Olympic National Park by C. H. Kauffman on his two expeditions to the area, the first in 1915 to Lake Cushman and the second to Lake Quinault in 1925; and by Dr. Alexander H. Smith on three expeditions;[2] the first in 1935, the second in 1939 and the third in 1941. On all of these the collecting of Discomycetes was incidental. Primary emphasis was placed on the gill fungi. Although the cup fungi fruit most abundantly during the spring and summer seasons in this area, only one spring season, that of 1939, was spent by the above collectors in the region. Consequently no reliable data are yet available on the seasonal variation in the appearance of most species.

As can be seen by a glance at a map, the collecting has been carried out largely around the periphery of the Peninsula and at elevations varying from sea level to five thousand feet. During the spring of 1939 Smith collected in the higher regions of the Sol Duc River drainage as well as in the Boulder Creek drainage above Olympic Hot Springs. Several collecting trips to the higher elevations around Mount Angeles were also made. These stations are all located on the northern side of the Peninsula. The drier area which occupies the northeastern part of the Peninsula, the central mountain mass which occupies the interior, and the southern base of the Peninsula, as yet, remain unexplored as far as the Discomycete flora is concerned. The areas which have been most intensively studied are the river valleys of the

[1] Papers from the University Herbarium, University of Michigan.

[2] Dr. Smith's expeditions were made possible by grants from the Horace H. Rackham School of Graduate Studies of the University of Michigan.

western slope of the mountains from Lake Quinault to Cape Flattery and the northern side of the Peninsula, particularly in the vicinity of Lake Crescent and the mountains immediately to the south.

That the region contains a rich and varied Discomycete flora is evidenced by the following: from the 408 collections studied 173 species were identified. These represent seventy-four genera. Three new genera have been described previously: *Gelatinodiscus* and *Pseudocollema* by Kanouse and Smith (**1940**), and *Pseudociboria* Kanouse (**1944**). In addition, two new species, *Tryblidaria washingtonensis* and *Ciboria rufescens*, have been published (Kanouse, **1941**).

The following species are here described as new. Two of these were not collected in the Olympic area, but will undoubtedly be found there. *Ascophanus brunneus; Belonioscypha minuta: Discina olympiana; Discinella washingtonensis; Humaria stellata; Humarina washingtonensis; Hyalopeziza Pteridis; Lachnaster miniatus; Ombrophila Lysichitonis; Phialea pallida; Phialea olympiana; Rutstroemia microspora.* Nine new combinations are made: *Humaria albocincta; Humaria coprinaria; Humaria crucipila; Humaria diplotricha; Humaria erinacea; Humaria melaloma; Humaria theleboloides; Ascophanus granulatus* var. *robustus; Chlorociboria aeruginascens; Phialea cyathoidea* var. *minutula; Dasyscypha capitata.* Two new names are given: *Ascophanus Velenovskýi; Lachnum bohemicum.*

The writer wishes to express her appreciation to Dr. A. H. Smith for his interest in this group and for collecting the specimens, also for his description of the area in which the work was carried out. Many thanks are due to Mr. Aurèle La Rocque for the preparation of the Latin diagnoses.

All collections have been deposited in the Herbarium of the University of Michigan.

All numbers cited are those of A. H. Smith unless otherwise stated. The identifications were made by the author unless a statement is made to the contrary. In addition to the reference to the publication of the name which is used, a second citation is sometimes given to a more complete or more accessible description, and for some species, a reference to an illustration is also given.

LIST OF SPECIES

ALEURIA AURANTIA (Fr.) Fuck. Symb. Myc. p. 325. 1869–1870; Seaver (1942, pl. 49).

This is a common species in the area. It is easily recognized by its bright orange color and by its reticulate-roughened spores. Seaver (**1928**) gives a good description and illustration.

On ground, Lake Ozette, Sept. 25, 1935, (*2602*); Cape Flattery, Oct. 1, 1935, (*2769*); Hoh River, June 30, 1939, (*14703*). Two collections, Lake Quinault, 1925, C. H. Kauffman and C. A. Brown.

ALEURINA ATROVINOSA (Cke.) Seaver. North American Cup-fungi, p. 101. 1928.

When fresh the apothecia measure 1–3 cm. in diameter and are colored "Prout's Brown"* to "Saccardo Umber." When dry the color is nearly black. The spores are sculptured.

Mt. Angeles, Sept. 21, 1941, (*17109*); Joyce, July 5, 1939, (*14788*).

APOSTEMIDIUM VIBRISSEOIDES (Pk.) Boud. Ann. Myc. **4**: 240. 1906; Durand, p. 457. 1908.

The hymenium is pale gray to "deep olive buff" when fresh. The paraphyses which have colored tips distinguish this species from *A. guernisaci* (Cr.) Boud. According to Durand it is seldom collected.

On a wet stick, Lake Crescent, June 3, 1939, (*14020*).

ASCOBOLUS GEOPHILUS Seaver. Mycologia **8**: 96. 1916.

The mucilaginous substance in which the spores are imbedded is bright yellow-green in color. The spores are marked with fine lines or ridges which form reticulations. As Seaver has pointed out, the number of spores in an ascus is frequently four instead of the usual eight. This collection extends the range to the western United States.

On earth, Elwha River, June 23, 1939, (*14599*).

* Color names within quotation marks are taken from R. Ridgway, Color Standards and Color Nomenclature. 1912.

ASCOBOLUS GLABER (Pers.) Fr. Syst. Myc. **2**: 164. 1823; Rehm, (1887–1896, p. 1121).

Apothecia substipitate, up to 1 mm. in diam., pale olive in color when fresh, smooth, margin somewhat ragged; asci 120–130 × 19–22 μ; spores 19–23 × 9–10 μ, purple brown, marked with longitudinal striations.

There is a wide variation in the sizes of asci and spores reported for this species. Seaver (l.c.) gives the asci as 300–350 × 40 μ and the spores as 23–38 × 12–13 μ. This exceeds the size found in our collections. The measurements given by Rehm (l.c.) and by Phillips (**1887**) are more like those reported here. It is, of course, impossible to know what the spore size was in the material Fries had when he accepted Persoon's species. Rehm's interpretation is followed here.

On cow dung, Elwha River, June 8, 1939, (*14186*); Hoh River, June 30, 1939, (*14704*).

ASCOBOLUS STERCORARIUS (Fr.) Schroet. Cohn's Krypt. Fl. Schles. **3** (*2*): 56. 1893; Seaver, p. 82. 1928.

A common species in the United States. On dung, Joyce, June 9, 1939, (*14223*).

ASCOPHANUS CERVARIUS (Phill.) Boud. Hist. et Class. des Discomycètes d'Europe. 1907. Originally described by Phillips (**1879**) as *Peziza cervarius*.

This species is distinguished in part by the brown color, by the asci which are abruptly attenuated at their apices, and by a negative reaction to iodine. The hyaline spores measure 15–17 × 7–9 μ. The paraphyses are hyaline, filiform, not enlarged at their apices, and are often branched above. As far as the writer can determine, this species has not been collected previously in the United States. Rea collected it in England.

On dung (woodchuck ?), Lake Crescent, May 27, 1939, (*13759*).

Ascophanus brunneus sp. nov. (FIGS. 1–3)

Apothecia solitaria, 0.5–1 cm. in diam., late sessilia, margine erecto, cinnamomea ad atro-brunnea; asci cylindracei, 225–250 × 16 μ, octospori; sporae

20–24 × 9–11 μ, ellipsoideae, hyalinae, leves; paraphyses filiformes, in maturitate confluentes et confusae.

Ad fimum, Lake Quinault, Washington, 4 Junii, 1939, No. *14062*, **Typus.**

Apothecia solitary, 0.5–1 cm. in diam., broadly attached, the margin up-raised, drying somewhat scalloped, externally cinnamon brown near the margin when fresh, becoming blackish brown downward, substance soft; hymenium dark brown to blackish brown (when dry), lighter at the margin; hypothecium prosenchymatic; asci cylindrical, 225–250 × 16 μ, the ascus tips becoming deep blue in iodine, 8-spored, spores uniseriate in the asci; spores 20–24 × 9–11 μ, ellipsoid, hyaline, smooth; paraphyses filiform, not enlarged upwards, 3 μ or less in width at the apices, colorless, clumps of paraphyses fusing and becoming indistinguishable in mature apothecia.

The large size of the apothecia and the dark brown color distinguish this species from others in this genus.

ASCOPHANUS GRANULATUS (Fr.) Speg. Mich. 1: 255. 1879.

On dung, Joyce, June 9, 1939, (*14221, 14842*).

A study of a number of collections from the Western United States has shown that two distinct fungi have been included under this name. In one of them the paraphyses measure 5–7 μ at the apices and are narrowly clavate. In the other they measure 14–18 μ and are subcapitate. C. A. Brown collected fungi with the narrow paraphyses at Lake Quinault, Washington, October 21, 1925. L. E. Wehmeyer collected the same at Mt. Hood, Oregon, October 4, 1922, and Snyder (1938) reported it from Washington under the name *Humarina granulata* (Bull. ex Fr.) Snyder. We also have an additional collection in the University of Michigan Herbarium from Tennessee (Underwood and Sharp No. *5406*). The spore size in all of these collections is 14–16(18) × 7–8(9) μ as reported by Snyder.

Rehm described a fungus in Ascomyceten Exsiccati No. *1357c* under the name *Humaria granulatus* (Bull.) Quél. In this collection the paraphyses measure 12–15 μ but Rehm reported them to be 8 μ. We have two collections made by A. H. Smith (Nos. *14221* and *14842*) in which the paraphyses are as broad as the asci which are about 18 μ in diameter. It is clear from the present study that these two units are distinct and that they represent

good varieties. Starbäck (**1898**) was cognizant of a difference in the material that he had available for study and he proposed the name *robusta* for the unit with the large paraphyses. Seaver (l.c.) did not mention Starbäck's variety in his synonymy of *A. granulatus,* although he obviously had it instead of the typical variety. In view of this situation it appears that Starbäck's arrangement offers the most satisfactory solution of the problem, and is the one accepted here. Consequently the fungus with the slender paraphyses as described but not so distributed by Rehm is designated as variety *typica* and the epithet *robusta* is used in the sense in which Starbäck intended. However, since Starbäck described the variety under the genus *Humaria,* it becomes necessary to make a transfer to the genus *Ascophanus* and the combination **Ascophanus granulatus** var. **robustus** (Star.) comb. nov. is proposed.

Another point in regard to *A. granulatus* needs to be clarified. Velenovský (**1934**) described a species as *Ascophanus granulatus* but since his name represents a later homonym it is invalid. However, his species as described does not appear to be identical with any other in the genus and the name **Ascophanus Velenovskýi** nom. nov. is proposed for it.

Rehm stated that some American and English collections, including Ellis and Everhart North American Fungi No. *2039,* which the writer has examined, agree with the collections in Europe. He cited an illustration by Cooke (**1879**), as a good representation of the fungus. Cooke's figures show slender paraphyses which fact is at variance with Rehm's Ascomyceten No. *1357c.*

ASCOPHANUS OCHRACEUS (Cr.) Boud. Ann. Sci. Nat. Ser. V. **10**: 247. 1869; Seaver, p. 117. 1928.

On cow dung, Cape Flattery, May 27, 1939, (*13783*).

Belonioscypha miniata sp. nov. (FIGS. 4–6)

Apothecia gregaria, stipitata, 0.2–0.4 mm. in diam., plana, margine leviter involuto et rugoso granulis informis; stipes 50 μ altus, hypothecium pseudoprosenchymaticum; asci cylindraceo-clavati, 50–70 × 6–9 μ, octospori, sporae biseriatae in asco; sporae cylindraceo-fusoideae, subhyalinae, triseptatae, 10–12 × 2–3 μ; paraphyses filiformes, hyalinae, ultra ascum protrusae.

In caules vetustas caricis, Lake Tahkenitch, Oregon, 19 Novembris, 1935, No. *3552,* **Typus.**

Apothecia gregarious, stipitate, 0.2–0.4 mm. in diam., flat when moist with the margin slightly inrolled, delicately roughened by granules of an amorphous deposit outlining the cup, creamy yellow when fresh, drying pale yellow; stipe 50 μ in height; hypothecium pseudoprosenchymatic; asci cylindric-clavate, 50–70 × 6–9 μ, eight-spored, ascus pore becoming blue in iodine; spores usually biseriate, cylindric, with pointed ends, straight to slightly curved, subhyaline, three-septate, 10–12 × 2–3 μ; paraphyses filiform, hyaline, not enlarged at the apices, projecting slightly beyond the asci but not forming an epithecium.

The infected area of the leaf blade was outlined by an irregular darkened band which did not touch the fungus. It is not stroma-like, and it is not known how much importance its presence has in connection with the apothecia, but the two infected leaves that constitute the collection both show this character. Although so far known only from Oregon, this species is to be expected in the Olympic area in the vicinity of such lakes as Lake Ozette.

CENANGIUM FERRUGINOSUM Fr. Syst. Myc. 2: 187. 1823; Rehm, p. 227. 1889.

The spores measure 9–11 μ. The paraphyses are usually filiform but are infrequently branched above. Rehm (l.c.) gives a good description under the name *Cenangium Abietis* (Pers.) Fr.

On coniferous sticks, Mora, May 22, 1939, (*13676*).

Chlorociboria aeruginascens (Nyl.) Kanouse comb. nov. Not. Sällsk. F. Fl. Förh. **X.**

In making a revision of the genus *Chlorosplenium,* Seaver (**1936**) presents an acceptable solution concerning the limits of the genus. He retains *C. chlora* as the type of the monotypic genus. Under *Chlorociboria aeruginosum* he placed *C. aeruginascens* (Nyl.) Karst. in synonymy. The writer finds that there is a difference in the spore size of these two species and therefore considers them to be distinct. Rehm recognized the two species partly on the basis of spore difference. The spores of *C. aeruginascens* are 6–8 × 1.5–2 μ. In *C. aeruginosum* they measure 10–14 × 2.5–3.5 μ.

On *Alnus* sp., Boulder Lake, 4,500 ft. elev., May 28, 1939, (*13814*); on *Alnus* sp., Lake Quinault, June 2, 1939, (*13989*).

CIBORIA CAUCUS (Fr.) Fuck. Symb. Myc. p. 311. 1869–1870.

This species is the type of the genus *Ciboria*. The fruit bodies arise from black stromas on the *Alnus* fruits. Whetzel (**1945**) made the presence of a sclerotium a generic character and restricted the genus to those species that fruit on catkins and seeds. This is a more limited characterization of the genus than has been previously followed and it remains to be seen whether or not this concept will be found to be completely satisfactory.

On cones of *Alnus* sp., Lake Crescent, June 3, 1939, (*14026*).

CIBORIA RUFESCENS Kanouse. Mycologia **33**: 463. 1941.

This species is distinguished in part by the bright red coloring matter which is soluble in water. It grows on wet leaf packs.

Lake Quinault, May 17, 1939, (*13491, 13509*); on *Alnus* leaves, Spruce, Hoh River, May 19, 1939, (*13576, 13578, 13579*); Lower Hoh River, June 6, 1939, (*14149*); Lower Hoh River, June 30, 1939, (*14710*).

CIBORIA RUFOFUSCA (Weber) Sacc. Syll. Fung. **8**: 203. 1889.

Apothecia stipitate, up to 1.5 cm. in diameter, "Prout's brown" when fresh; stipe up to 1.5 cm. in length; asci 45–55 × 4–5 μ; spores 4–6 × 2–3 μ; paraphyses filiform.

On scales of cones of *Abies* sp., Boulder Lake, 4,500 ft. elevation, May 28, 1939, (*13808*); Deer Lake, June 13, 1939, (*14330*).

Probably this is the first instance of this species being found in the United States. In certain respects it complies with the specifications of the genus *Ciboria* according to Whetzel's definition; however there is no sign of sclerotia or stroma. Regardless of this fact the fungus seems best placed in *Ciboria* where Saccardo (l.c.) and Rehm (**1893**) included it.

CIBORIA TENUISTIPES Schroeter. Die Pilze Schlesiens 2 Hälfte —Krypt.-Fl. v. Schlesien, Dritter Band, p. 61, 1893–1908.

Apothecia stipitate, gregarious, arising from leaf blades or veins without stroma, 2 mm. in diameter, remaining expanded after drying, margin slightly scalloped, the free ends of the excipular cells forming a pubescence, hymenium dull brown, the outside of

the cup mouse gray; stipe 3–10 mm. in height, expanding upwards into the cup; asci eight-spored, spores uniseriate in the asci, ascus pore not blue with iodine; spores hyaline, one-celled, 7–9 × 3–4 μ; paraphyses hyaline, filiform.

On *Alnus* leaves, Forks, May 22, 1939, (*13671*).

CISTELLA DENTATA (Fr.) Quél. Ench. Fung. p. 319. 1886.

Apothecia scattered, pale watery gray, sessile, minute, frequently not over 300 μ in diam., excipular cells near the margin differentiated into hyphal extensions that are grouped together in fascicles making the margin appear dentate; asci short cylindric, 30–40 × 6 μ, ascus pore blue with iodine; spores 5–6 × 2.5 μ, biseriate in the asci, straight, one-celled, hyaline; paraphyses filiform.

On sticks of maple, Lower Hoh River, May 18, 1939, (*13538*).

This is one of the old pre-Friesian species. It is a minute fungus, scarcely visible to the unaided eye when dry, yet it is fairly easily recognizable by means of the characteristic dentate margin of the apothecia together with the small size. Nannfeldt (**1932**) has proposed a good arrangement of a group of minute wood-inhabiting fungi which he puts in the family Hyaloscyphaceae. His treatment in this difficult group is the best known. The morphological characters upon which a classification must be based are largely those of the nature of the excipular hairs, marginal hairs and the type of paraphyses present. The genus *Cistella* is characterized by having small apothecia which are attached to the substratum by means of a small central attachment (not truly substipitate). The paraphyses are not lance-like, the hairs are thin-walled, septate, and arise from the excipular cells without being differentiated from the basal cell. The tips of the hairs are more or less club-shaped, often there are minute roughenings; marginal hairs are often arranged in broad teeth.

CISTELLA GEELMUYDENII Nannf. Studien über die Morphologie und Systematik der nicht-Lichenisierten Inoperculaten Discomyceten. p. 270. 1932.

Apothecia gray-white, translucent, delicately fringed at the margin, minute, 0.1 mm. in diam., marginal hairs frequently ar-

ranged in tooth-like fascicles; asci 35–40 × 6–7 μ; spores 5–6 × 1.5–2 μ.

On wood debris, Hoh River, May 7, 1939, (*13219*).

CISTELLA XYLITA (Karst.) Nannf. (l.c.).

Nannfeldt has made a sharp distinction between species on the basis of substratum. He reports this one as limited to *Populus*. Our collection appears to be on *Alnus rubra*. It was found at Lake Ozette, May 15, 1939, (*13435*).

CLITHRIS GRAPHIS Rehm. Ann. Myc. **7**: 533. 1909.

On fir, Lake Crescent, June 15, 1939, (*14391*); on pine, Crystal Ridge, June 17, 1939, (*14422*), and on fir, June 17, 1939, 4,800 ft. elev., (*14423*).

In the collection (*14422*) on pine the apothecia are heaped up in small piles instead of being sparingly scattered and graphis-like.

This species was described from specimens collected on "ramum corticatum balsamea" E. T. and S. A. Harper No. *2331* from San Juan Island, Washington. Our material agrees well with Rehm's description.

CLITHRIS JUNIPERI (Karst.) Rehm. Die Pilze Deutsch. Öester. u. der Schweiz. Lief. 29 (1888), in Rabenhorst Kryptogamen-Flora Bd. 1.

The apothecia are black and erumpent. The spores are one-celled and filiform. The paraphyses are flexuous and curled at their apices.

In Ascomyceten Exsiccati No. *272b*, Rehm described this species from *Juniperus nana*. This collection has been examined by the writer. Miss Cash reported this species from California, (Parks No. *5522*), on *Abies grandis*.

On coniferous twigs, Lake Crescent, June 15, 1939, (*14379*).

CUDONIA CIRCINANS Fr. Summa veg. Scand. p. 348. 1849.

Lake Crescent, Sept. 21, 1935, (*2535*); Boulder Creek, Oct. 5, 1935, (*3165*); Boulder Creek, Oct. 14, 1935, (*3136*); Boulder

Creek, Oct. 15, 1935, (*3164*); Forks, June 8, 1939, (*14435*); Joyce, June 9, 1939, (*14229*); Mt. Angeles, June 28, 1939, (*14677*); Joyce, July 5, 1939, (*13796*). Identifications were made by E. B. Mains.

CUDONIA GRISEA Mains. Am. Jour. Bot. **27**: 322. 1940.

Hoh River, May 18, 1939, (*13521*); Olympic Hot Springs, June 5, 1939, (*14100*); on coniferous wood, Sol Duc Park Trail, June 19, 1939, (*14482*). Identifications were made by E. B. Mains.

CUDONIA MONTICOLA Mains. Am. Jour. Bot. **27**: 322. 1940.

Cape Flattery, May 27, 1939, (*13785*); under fir, Lake Crescent, June 3, 1939, (*14009*); June 6, 1939, (*14060*). Identifications were made by E. B. Mains.

CYATHICULA ALPINA E. & E. Proc. Phil. Acad. Nat. Sci. p. 349. 1894.

This delicate fungus is stipitate with translucent, shining cups. The tooth-like fascicles of hairs at the margin measure 60–80 μ broad and 40 μ long. The asci are eight-spored; spores 6–9(10) $\times$ 1.5–2 μ; paraphyses filiform.

On *Equisetum* sp., Spruce, May 19, 1939, (*13584*); on stems, Boulder Lake, 4,500 ft. elev., May 28, 1939, (*13812*); on herbaceous stems (*Delphinium* sp.?), Sol Duc Park Trail, June 21, 1939, (*14485*).

CYATHICULA AQUILINA (Rehm) Sacc. Syll. Fung. **8**: 307. 1889.

Apothecia sessile, translucent when fresh, changing to "chamois" when dry; marginal hairs in tooth-like fascicles, measuring up to 500 μ in length; spores 8–10 $\times$ 4 μ; paraphyses much branched.

On fern debris, Kalaloch, May 10, 1939, (*13302*); on *Gaultheria shallon* Pursh., Lake Crescent, June 2, 1939, (*13472*).

DASYSCYPHA AGASSIZII (B. & C.) Sacc. Syll. Fung. **8**: 438. 1889.

On Douglas fir, Olympic Hot Springs, June 5, 1939, (*14098*); Deer Park, 5,100 ft. elev., June 16, 1939, (*14412*).

The traditional and probably the most acceptable description of the genus *Dasyscypha* is that published by Hahn and Ayers (**1934**). They review the interpretations of the genus that have been made and retain the name *Dasyscypha* for the *Lachnum*-like fungi with the filiform paraphyses in contrast to the genus *Lachnum* in which the paraphyses are lance-like. In general this is also the interpretation of the genus according to Rehm (**1893**). Nannfeldt (**1932**) would reduce the genus to synonymy with *Lachnum*.

Dasyscypha capitata (Pk.) comb. nov. (*Peziza capitata* Pk. 30th Rept. N. Y. State Mus. 1878.)

On old leaves, Lake Ozette, May 15, 1939, (*13424*).

The hairs are capped with large conspicuous stellate crystals. The spores measure 7.5–9 × 2 μ.

DASYSCYPHA ELEGANTULA (Karst.) Rehm, p. 852. 1896; Nannfeldt, p. 119. 1928.

Apothecia stipitate, covered thickly with long flexuous hairs, clove brown in color with hyaline tips; asci 90–100 × 10 μ, eight-spored; spores 13–15 × 3.5 μ, hyaline; paraphyses numerous, filiform, hyaline.

On *Delphinium* sp., 4,500 ft. elev., Boulder Lake Trail, May 28, 1939, (*13801*).

This interesting fungus has not been reported from the United States as far as can be determined. It has been found in Finland and Lapland (Karsten), from the Alps (Rehm), from Norway (Rostrup) and from Sweden (Lind). Nannfeldt (l.c.) gives its complete synonymy. The name *Dasyscypha fusco-brunnea* Rehm has been assigned to this species, but Nannfeldt places it in synonymy with *D. elegantula*. The spore measurements in the Washington collections are slightly larger than those given by Karsten and by Rehm, being 13–15 × 3.5 μ as compared with 6–15 × 2–

2.5 μ in Rehm's report. It is possible that the presence of the dark brown hairs together with the difference in spore size will be found to be important enough to justify re-establishing as a valid species *D. fusco-brunnea* which Rehm reported from the Atlas Mountains.

DASYSCYPHA PULVERULENTA (Lib.) Sacc. var. PURPURASCENS Rehm. Ann. Myc. **8**: 298. 1910.

The apothecia are small, bright canary yellow, and with patches of bright red extraneous material that cling to the hairs. On drying the red material (which may be resinous in nature) becomes tinged violet. The hairs are somewhat drawn together into bundles by the material adhering to them. The spores of this variety are slightly smaller than those reported for typical material. They measure 4–6 × 1.5 μ as compared with 5–8 × 1.5–2 μ in the typical variety.

On fir needles, Lake Crescent, June 2, 1939, (*13967*).

DESMAZIERELLA ACICOLA Lib. Ann. Sci. Nat. **17**: 83. 1829; Boudier, Icon. Mycol. **3**. 1905–1910. pl. 363.

The fungus is striking in appearance owing to the unusual paraphyses. They are branched above the middle, and the terminal portions are both pointed and dark brown. The exciple is sparsely covered with stellate hairs which measure 250–300 μ in length. The spores are smooth, hyaline, ellipsoid, and measure 15–18 × 10 μ. The asci are eight-spored. The species is rarely collected to judge from the infrequent reports in the literature. Boudier (l.c.) has an excellent illustration.

On needles of hemlock, Kalaloch, May 10, 1939, (*13305*).

DISCINA APICULATA (Cke.) Seaver. Mycologia **3**: 70. 1921.

Apothecia 2 cm. in diam., 2 cm. in depth, substance soft-watery, color of exciple "buffy brown," hymenium "olive brown" when fresh; spores ellipsoid, truncate with small flat apiculae, pale brown finally becoming minutely roughened; paraphyses colored at their apices.

On old cardboard carton, Hoh River, June 6, 1939, (*14153*); on an *Alnus* log, Hoh River, June 30, 1939, (*14723*).

These collections establish a record of this species for the United States. Seaver (**1928**) seems to cast doubt upon its occurrence in this country, but his description fits our western material very well.

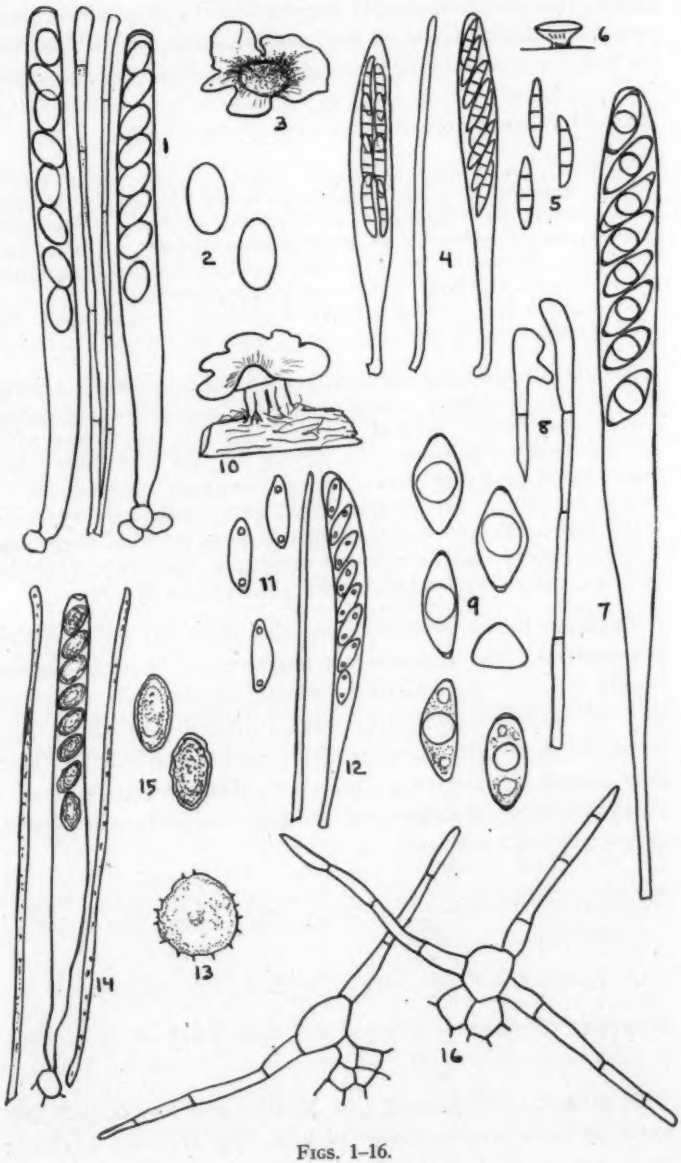
Discina olympiana sp. nov. (FIGS. 7–9)

Apothecia dispersa, 1.5–3 cm. in diam., stipitata, substantia mollis crassaque, stipes 2–3 mm. latus, 2–3 mm. altus, rugosus in sicco, cremeus; hymenium luteolo-olivaceum, in sicco atrobrunneum, planum ad convexum, asci cylindracei, in caulem longum gracilemque acuens. Pars sporophora 275–300 × 20–22 μ, octospora, sporae uniseriatae; sporae subtrihedrales, ellipsoideae in uno aspectu, in altero late fusoideae, parietibus crassis, 30–32(36) × 12–14(16) μ, leves, saepe pileoloideis apiculis, uni- ad triguttulatae; paraphyses robustae, fasciculatae, brunneae, 7–9 μ.

Ad terram, Boulder Lake Trail, Olympic National Park, Washington, 28 Maii, 1939, Smith No. *13828*, **Typus.**

Apothecia scattered, 1.5–3 cm. in diam., stipitate, substance soft, thick; stipe 2–3 mm. in diam., 2–3 mm. high, wrinkled when dry, gradually expanded into the cup, cream to flesh-colored; hymenium "tawny olive" when fresh, drying blackish brown, flat with edge rolled under; hypothecium pseudoprosenchymatic; asci cylindric, tapering into a long slender stalk which readily collapses, the spore-bearing part 275–300 × 20–22 μ, eight-spored; spores uniseriate, asci not blue with iodine; spores subtrihedrate (like beech nuts), in one view truly ellipsoid, in another broadly fusoid to diamond-shaped, thick-walled, 30–32(36) × 12–14(16) μ, smooth, sometimes thickened at the ends to form small flat apiculae, containing one large highly refractive oil drop, frequently also containing two smaller oil drops; paraphyses stout, bunched together in fascicles, brown in color, 7–9 μ at their apices.

This fungus seems to be near *Discina perlata* Fr. but is a smaller plant and the spores are different. In *D. perlata* the spores are narrowly fusoid and are furnished with prominent apiculae, whereas in *D. olympiana* the spores are strongly three-sided. In one view they appear narrow and in another they are almost diamond shaped. This fact was ascertained by observing spores rotating in a water mount. The apiculae are inconspicuous in many of the spores. The outer wall of the spore appears to be of medium thickness and somewhat gelatinous. On drying the apiculae of the spores are more easily seen than when in a distended condition. The apiculae are not as easily observed on spores revived in KOH. Rehm re-



FIGS. 1–16.

marked that certain species of *Discina* lack the blue coloration in iodine. Boudier established the genus *Disciotis* for such species, but it does not seem to the writer to be a sound generic distinction.

Discinella washingtonensis sp. nov. (FIGS. 10–12)

Apothecia dispersa, brevistipitata, ex trama irregulare hyphis luteolis oriunda, hymenium planum ad convexum, 6–12 mm. in diam., hypothecium molle, crassum, parenchymaticum, pallide grisea, exsiccanda cinnamomea, centro olivascente; stipes 3–5 mm. altus, apothecio concolor; asci cylindracei, 80–90 × 8 μ. Octospori; sporae anguste fusoideae, symmetria variabiles, (11)12–14 × 4 μ, unicellulae, hyalinae; paraphyses filiformes.

Ad ramulum arboris caducae, Forks, Washington, *22* Maii, Smith No. *13668*, **Typus.**

Apothecia scattered, 6–12 mm. in diam., short stipitate, arising from a weft of cottony yellowish hyphae, stipe short, expanding broadly upwards into the cup, 3–5 mm. in length, concolorous with the apothecia; hymenium flat, drying slightly umbilicate, dull watery-pallid gray when fresh, drying "cinnamon" with olivaceous tints at the center; hypothecium thick, soft, pseudoparenchymatic; asci cylindric, 80–90 × 8 μ, eight-spored, ascus pore becoming blue in iodine; spores narrowly fusoid, varying in symmetry, (11)12–14 × 4 μ, one-celled, hyaline, smooth; paraphyses filiform.

The fungi in this genus resemble operculates but are in reality inoperculates. The apothecia are characterized by their dentate margin and their subtomentose exterior together with the small asci. *D. washingtonensis* approaches *D. Boudieri* in size of apothecia and spores but is distinguished from that species by the pale gray instead of the bay-purplish color. The habitat is also distinctly different. Boudier found his species on sandy soil whereas ours is a lignicolous fungus.

GEOPYXIS CUPULARIS (Fr.) Sacc. Syll. Fung. **8**: 72. 1889; Seaver, p. 212. 1928.

On burned soil, Forks, May 31, 1939, (*13937, 13944*).

GEOPYXIS VULCANALIS (Pk.) Sacc. Syll. Fung. **8**: 65. 1889. Seaver, p. 214. 1928.

On ground, Lake Quinault, Oct. 26, 1925, and Nov. 6, 1925, collected by C. A. Brown; Lake Quinault, May 17, 1939, (*13507*);

Graves Creek, May 23, 1939, (*13721*); Port Ludlow, May 30, 1939, (*13894*); Lake Crescent, June 3, 1939, (*13721, 14015*).

GELATINODISCUS FLAVIDA Kanouse and Smith. Mycologia **32**: 756. 1940.

Apothecia gelatinous, short stipitate, smooth; spores ellipsoid, smooth, subflavidous; paraphyses filiform, branched.

On *Chamaecyparis nootkatensis* Sudw., Sol Duc Park, June 20, 1939, (*14488*).

GODRONIA DAVIDSONI Cash. Mycologia **26**: 269. 1934.

Miss Cash described this species from specimens on *Ribes* from Colorado. Our collections are like hers in every respect.

On dead canes of *Rubus* sp., Lake Crescent, June 17, 1939, (*14342*).

GODRONIA URCEOLUS (Fr.) Karst. Rev. Mon. p. 144. 1891; Cash (l.c.).

On *Acer circinatus* Pursh., Lake Crescent, June 13, 1939, (*14345*).

HELOTIUM CARABORUM Vel. Mono. Discom. Bohem. Pars. 1. p. 208. 1934.

Apothecia minute, less than 1 mm. in diam., short stipitate, soft waxy, milky gray with a brownish margin; asci 60–90 × 6–8 μ, cylindric-clavate, eight-spored, spores obliquely uniseriate, ascus pore blue in iodine; spores one-celled, hyaline, 8–10(12) × 4–5 μ, ovate-elliptical, containing several oil drops; paraphyses filiform, slightly enlarged and brownish at the apices.

On moss, Lake Crescent, June 2, 1939, (*13979*).

In addition to several other species described on moss by Velenovský, the following have been reported also on that substratum by other authors: *H. bryogenum* Pk., *H. fuscobrunneum* Pat. & Gail., *H. turbinatum* (Fuck.) Boud.; *H. destructor* (Pk.) White. *H. caraborum* differs from all of these.

HELOTIUM CITRINUM Fr. Summa veg. Scand. p. 355. 1849; Rehm, p. 772. 1893.

On sticks, Lake Crescent, May 17, 1939, (*13508*); Hoh River, May 18, 1939, (*13527*); Lake Quinault, Oct. 22, 1925, collected by C. H. Kauffman and C. A. Brown.

HELOTIUM DESTRUCTOR (Pk.) White. Mycologia 34, p. 163. 1942.

On liverwort on a log, Kalaloch, April 23, 1939, (*12052*).

This species is frequent in northern Michigan. It is parasitic on liverworts and mosses and is easily spotted in the field by the dead patches which it produces. They are in sharp contrast to the green of the living plants adjacent to them. The apothecia are small, stipitate and colored "ochraceous buff" when fresh. This species has been reported as *Peziza subcarnea* Cke. & Pk., *Phialea subcarnea* (Cke. & Pk.) Sacc. and *Hymenoscypha subcarnea* (Cke. & Pk.) Kuntze. White's disposition of the fungus in the genus *Helotium* is the most acceptable.

HELOTIUM EPIPHYLLUM Fr. Summa. veg. Scand. p. 356. 1849; White, p. 139. 1943.

The apothecia arise in most cases from the veins of the leaves. No stroma is present. The color when fresh is "amber yellow."

On *Alnus* leaves, Lake Crescent, June 3, 1939, (*13932*).

HELOTIUM IMBERBE Fr. Summa veg. Scand. p. 356. 1849; Rehm, p. 775. 1893.

On *Alnus* bark, Lake Quinault, May 17, 1939, (*13493*); on sticks, Hoh River, May 23, 1939, (*13638, 13632*); on sticks, Graves Creek, May 23, 1939, (*13723*); on sticks, Clearwater River, May 24, 1939, (*13739*); on *Alnus* bark, Lake Crescent, June 3, 1939, (*14028*); on sticks, Elwha River, June 23, 1939, (*14593*).

HELOTIUM PHIALEA Fr. Summa veg. Scand. p. 355. 1849; Rehm, p. 784. 1893.

The color of the apothecia when fresh is "warm buff," but changes to bright buff-yellow when dry. The stipe measures 7

mm. in height. The plant is stout. Spore measurements are 14–16 × 7–8 μ. The spores finally become two-celled.

On leaves of *Sambucus callicarpa,* Elwha River, June 23, 1939, (*14396*).

HELOTIUM SCUTULA var. CAUDATUM Karst. Myc. Fenn. 1: 112. 1871.

When fresh the plant is white, but it turns pale yellow when dried except for the rolled edge of the apothecium which becomes dark tan. The stem is rather stout and firm and is thickened in the middle. The spores measure 18–20 × 4–6 μ. In contrast to the spores in the typical variety which are two-celled, these are one-celled. The ascus pore turns blue weakly in iodine.

On leaves of *Salix,* Lake Crescent, June 3, 1939, (*14030*).

HELOTIUM SCUTULA var. GROSSULARIAE Kauff. Papers Mich. Acad. Sci. Arts and Letters 1: 107. 1921.

This variety was described from material collected in Colorado on *Grossularia* sp. When fresh the color is avellaneous. The spores are smaller than in typical material. They measure 14–18 × 3.5–4 μ.

On herbaceous stems, Lower Hoh River, May 18, 1939, (*13533*).

HELOTIUM SCUTULA forma RUBI Rehm. Hedw. p. 229. 1885.

The one-celled spores measure (12)14–18 × 3–4 μ. They are slightly curved and are almost pointed at one end. Rehm described it from Europe. This appears to be the first report from North America.

On *Rubus* stems, Kalaloch, May 2, 1939, (*13076*).

HELVELLA CALIFORNICA Phill. Trans. Linn. Soc. Sci. II. 1: 423. 1880; Seaver, p. 250. 1928, 1942, pl. 70.

Represented by seven collections: Hoh River, May 7, 1939, (*13172*); Jackson Guard Station, May 13, 1939, (*13378*); Spruce, May 19, 1939, (*13557*); Hoh River, May 20, 1939, (*13643*);

Graves Creek, May 23, 1939, (*13719*); Elwha River, June 12, 1939, (*14286*); Hoh River, June 30, 1939, (*14720*).

The collection from Elwha River (*14286*) consisted of a fruiting body of unusually large size. It measured 16 cm. in width.

HELVELLA CRISPA Fr. Syst. Myc. 2: 14. 1823; Seaver, p. 247. 1928.

Olympic Hot Springs, Sept. 22, 1941, (*17185, 17192*); Mt. Angeles, Sept. 24, 1941, (*17216*); Chimacum, Oct. 13, 1941, (*17851*), collected by H. V. Smith.

HELVELLA ELASTICA Fr. Syst. Myc. 2: 21. 1823; Seaver, p. 249, pl. 40. 1928.

Lake Crescent, June 3 and June 5, 1939, (*14019, 14070, 14092*); Sol Duc Park Trail, June 20, 1939, (*14480*); Ennis Creek, June 25, 1939, (*14651*); Mt. Angeles, June 25 and June 28, (*14642, 14675*); Elwha River, July 3, 1939, (*14745*).

HELVELLA ESCULENTA Fr. Syst. Myc. 2: 16. 1823; Kanouse (**1947** in press).

Hoh River, May 7, 1939, (*13171*); Boulder Lake Trail, May 28, 1939, (*13815*); Deer Lake, June 13, 1939, (*14307*); Deer Lake, June 24, 1939, (*14617*); Mt. Angeles, June 29, 1939, (*14672*).

HELVELLA INFULA Fr. Syst. Myc. 2: 17. 1823; Seaver, p. 251. 1928; Kanouse, 1947.

Lake Quinault, Oct. 3, 1925, collected and identified by C. H. Kauffman; Lake Quinault, Oct. 20, 1915, collected by Mr. and Mrs. Puttnam; Hurricane Ridge, Sept. 25, 1941, (*17279*).

HELVELLA LACUNOSA Fr. Syst. Myc. 2: 15. 1823; Seaver, p. 246. 1928. As *H. mitra*, Morse (1945); Kanouse (l.c.).

Olympic Mts., Oct. 19, 1915, collected and identified by C. H. Kauffman; Lake Crescent, Oct. 6, 1935, (*3013*); Olympic Hot Springs, Oct. 19, 1935, (*3259*); Joyce, Oct. 28, 1935, (*3383*);

Hoh River, June 30, 1939, (*14709*); Bremmerton, Feb. 1940, collected by J. B. Flett; Olympic Hot Springs, Sept. 22, 1941, (*17183, 17180*); Chimacum, Nov. 13, 1941, collected by H. V. Smith (A. H. Smith No. *17861*).

Humaria albocincta (B. & C.) comb. nov. (*Peziza albocincta* B. & C. Grev. **3**: 154. 1875.)

This is a distinctive fungus characterized by the scarlet hymenium, very short hyaline hairs and by its growth on soil. The spores are rough.

On bare soil, Lake Quinault, May 21, 1939, (*13649*).

According to the International Rules of Nomenclature the name *Humaria* must be used for the species commonly relegated to the genus *Lachnea*. The names *Lachnea* and *Lachnaea* are invalid.

The name *Patella* that Seaver selected to avoid the use of *Lachnea* is also untenable as it is pre-Friesian. The name *Humaria* is valid but must be used in the strict sense of Fuckel (1869–1870). It must not be confused with the name *Humaria* of Saccardo. As the latter author used the name it is a synonym of the genus *Humarina*, as Seaver (**1928**) has pointed out.

Humaria coprinaria (Cke.) comb. nov. (*Peziza coprinaria* Cke. Grev. **4**: 91. 1875.)

The following collections were found on dung: Whiskey Creek, June 22, 1939, (*14549*); Hoh River, June 30, 1939, (*14725*); Elwha River, July 3, 1939, (*14747*); Joyce, July 6, 1939, (*14843*); Hurricane Ridge, July 7, 1939, (*14861*).

Humaria crucipila (Cke. & Phill.) comb. nov. (*Peziza crucipila* Cke. & Phill., Cooke, Mycographia, p. 136. 1876.)

The presence of the peculiar compound star-shaped hairs is the character by which this species is recognized. The color when fresh is pale ocher yellow. Seaver (**1928**) gives a good description under the name *Patella crucipila*.

On sticks, Lower Hoh River, May 18, 1939, (*13547*).

Humaria diplotricha (Rehm) comb. nov.

This fungus was described by Rehm (**1904**) as *Lachnea diplotricha* from material found on bare soil, in Ohio by C. A. Lloyd (Lloyd No. *02687*). Seaver (**1928**) placed it in synonymy with *Patella theleboloides* (A. & S.) Seaver. It seems to be distinct from *P. theleboloides,* however, on the basis of substratum, difference in spore size and a difference in color. Seaver (**1928**) reports the spores of *P. theleboloides* as 14–20 × 7–10 μ. Rehm gives the spores of *L. diplotricha* as 14–15 × 7–7.5 μ. Those in our western collections measure 14–16 × 8–9 μ which is more nearly like those in *L. diplotricha.* The color of the apothecia in our plants and *L. diplotricha* is some shade of orange rather than yellow. Our specimens, like those found in Ohio, were on bare soil rather than on dung.

On bare soil, Elwha River, June 3, 1939, (*14749*).

Humaria erinacea (Schw.) comb. nov. (*Peziza erinacea* Pers. ex Fr. Syst. Myc. **2**: 86. 1823.)

On wood of *Populus trichocarpa,* Lake Quinault, May 17, 1939, (*13510*).

Humaria Lusatiae (Cke.) comb. nov. (*Peziza Lusatiae* Cke. Monographia, p. 80. 1875.)

On cotton wood, Hoh River, June 6, 1939, (*14158*).

Humaria melaloma (Fr.) comb. nov. (*Peziza melaloma* Fr. Syst. Myc. **2**: 68. 1823.)

The distinguishing feature about this species is the presence of adpressed hairs on the outside of the apothecia. The hairs are septate and arise from large spherical, brown-walled cells. The spores in our collection measure (12)14–15 × 7–9 μ. They are smooth. The paraphyses are very slender and are not enlarged at their apices. They extend beyond the asci for a considerable distance.

On soil, Elwha River, July 7, 1939, (*14748*).

HUMARIA SCUTELLATA (L.) Fuck. Symb. Myc. p. 321. 1869–1870.

On decaying *Alnus* log, Graves Creek, May 23, 1939, (*13727*); on soil, Port Ludlow, May 30, 1939, (*13697*).

HUMARIA SETOSA Fuck. Symb. Myc. p. 321. 1869–1870.

On debris in mud, Lake Quinault, May 17, 1939, (*13406*); on *Alnus* log, Elwha River, July 4, 1939, (*14760*).

Humaria stellata sp. nov. (FIGS. 13–16)

Apothecia solitaria ad caespitosa, 2–3 mm. in diam., sessilia, plana ad convexa, irregularia cum stipata sunt, extus setis stellatis 70–100 × 12–20 μ sparse obtecta, eis plerumque bis ad quater furcatis, ex cellula tumida oriunda, pallide brunneis, parietibus crassis, septatis, apicibus obtusis; hymenium aurantiacum ad rubrum exsiccando fuscior; asci cylindracei, 200–225 × 10–12 μ, octospori; sporae uniseriatae, ellipsoideae, 16 × 10–12 μ, endospora crasse verrucosa, exospora tenuis, levis, in sicco rugulosa; paraphyses plurimae, filiformes.

Ad terram, Shuksan Inn, Washington, 14 Augusti, 1941; Smith No. *16162*, **Typus.**

Apothecia solitary to caespitose, 2–3 mm. in diam., sessile, flat to convex, irregularly cup-shaped when crowded, externally sparsely covered with stellate hairs, hairs 70–100 × 12–20 μ, usually from two to four arising from a swollen subspherical cell, hairs and basal cell with brown walls, hairs septate, blunt-tipped, the stellate hairs so arranged that the outer surface of the cup appears as if covered with an irregular, large-meshed net, the simple hairs also short; hymenium orange to red when fresh, orange when dry, pale creamy yellow when revived in water; asci cylindric, 200–225 × 10–12 μ, eight-spored, iodine not coloring the ascus; spores uniseriate, ellipsoid, 16 × 10–12 μ, hyaline, one-celled; the exospore thin, becoming somewhat wrinkled; endospore roughened with prominent warts; paraphyses numerous, filiform, hyaline, non-septate, scarcely widening at the apices and measuring 5 μ in diam.

There are only a few species described with stellate hairs. These are *Patella stercorea, P. curvipila, Lachnea alpina,* and *L. umbrorum.* With the exception of *L. umbrorum,* all have smooth spores. The hairs of *H. stellata* are sparse, and are composed of from two to five (usually two to three) radiating spines which

arise from a central swollen cell. The hairs, as well as the cells, are colored light brown, are short and stout, and are adpressed to the apothecia. A very few simple hairs are found scattered over the surface of the apothecia. The spores in *L. umbrorum* are rough and the measurements 23–24 × 12–14 μ are considerably greater than those in *H. stellata*. The small warty spores, together with the stellate hairs, are diagnostic for our species. The detail of the spore wall was studied with an oil immersion lens. It could not be clearly seen otherwise that the roughness was on the inner wall of the spore. An examination was made of the fresh spores of *Discina perlata* which also are roughened and are provided with apiculae. The roughening in this species also was found to be on the endospore wall. The outer wall is considerably thicker than in *H. stellata*. When spores of both species were mounted in a two per cent solution of KOH the apiculae and the wrinkled outer wall became smooth. The roughening is probably due to the drying down of the exospore over the warts on the endospore. This is an observation that may be found to throw light on the structure of roughened spore walls in species other than the two here mentioned.

HUMARIA STERCOREA (Pers. ex Fr.) Fuck. Symb. Myc. p. 321. 1869–1870; Seaver (1928 as *Patella stercorea*).

On cow dung, Queet's River, May 3, 1939, (*13093*).

Humaria theleboloides (Fr.) comb. nov. (*Peziza theleboloides* Syst. Myc. **2**: 88. 1823.)

The marginal hairs are scarce, as few as 14 were counted on some apothecia. The spores measure 18–20 × 10–14 μ and are without oil drops. The paraphyses are clavate-tipped.

Crescent Beach, Oct. 3, 1935, (*2851*); on cow dung, Crescent Beach, June 21, 1939, (*14509*); on dung of wild cattle, Hurricane Ridge, July 7, 1939, (*14862*).

HUMARINA OCHROLEUCA (Clem.) Seaver. North American Cup-fungi, p. 131. 1928.

On soil, Joyce, Sept. 24, 1935, (*2591*).

Humarina washingtonensis sp. nov. (FIGS. 17–19)

Apothecia gregaria ad stipata, in humo semi-infixa vel sessilia, pallide aurantia, in sicco pallidiora, concoloria, mollia, cerea, glabra, excipulum rugulosum, margo crenatus, in sicco vadose cupuliformis; hypothecium crassum, pseudoprosenchymaticum, cellulae magnae parietibus tenuibus; asci cylindracei, pedicellati, 175–200 × 9–10 μ; sporae leves, hyalinae vel subhyalinae, anguste ellipsoideae (14)16–18 × 7–9(10) μ, uni- vel biguttulatae; paraphyses filiformes, apice 6 μ, flavidulae.

Ad terram et ramulos deustos, Heart O' Hills, Washington, 25 Junii, 1939, Smith No. *14654*, **Typus.**

Apothecia gregarious to crowded, sessile, frequently partly embedded in the ground, "apricot buff" to "apricot orange" when fresh, paler when dry, concolorous throughout, soft, waxy, exciple faintly creased with ridges which extend downwards from the dentations on the margin of the cup, glabrous, remaining shallow cup-shaped on drying; hypothecium thick pseudoprosenchymatic, cells large, thin-walled; asci long cylindric, long pedicellate, the pedicel easily collapsing, 175–200 × 9–10 μ, eight-spored; spores smooth, one-celled, narrowly ellipsoid, (14)16–18 × 7–9(10) μ, containing one to two highly refractive guttulae, hyaline to subhyaline; paraphyses filiform, apices clavate, reaching 6 μ in diam. at their apices, faintly colored yellowish.

On burned soil and charred debris. Heart O' Hills, Washington, June 25, 1939, Smith No. *14654*—Type. Additional collections: Mora, May 22, 1939, (*13670, 13674, 13679*); Forks, May 31, 1939, (*13937*); Joyce, June 9, 1939, (*14228, 14219, 14227*). Also Lake Quinault, 1925, collected by C. H. Kauffman.

At least eight species are reported on carbonicolous substrata. However, none of them seems to apply to these collections. *Humaria rustica* Vel. approaches our plant in some respects, but since his description is so brief it is difficult to interpret the species. He gives the spores as "12–18 μ globose ellipticae" which ours definitely are not. *Humarina semiimmersa* (Karst.) Seaver resembles this in being partially immersed in the soil but *H. semiimmersa* grows to a much larger size.

HYALINA CRENATO-MARGINATA v. Höhnel. Frag. z. Mykol. Sitz. Akad. Wiss. Abt. I, Bd. 116, heft 1, Not. III, no. **134**. 1907.

The minute apothecia have delicately dentate margins. Unless wet they are inconspicuous because of their small size.

On *Alnus*, Graves Creek, May 23, 1939, (*13725*); on *Acer circinatum* Pursh, Forks, May 31, 1939, (*13941*).

HYALOPEZIZA CILIATA Fuck. Symb. Myc. p. 298. 1869; v. Höhnel (**1918**).

This is a minute fungus with apothecia measuring up to 0.6 mm. in diam. It is distinguished in part by the presence of very long strigose hairs which have thick walls and thin septa. The color when fresh is "pinkish buff." The genus *Hyalopeziza* is properly placed in the Hyaloscyphaceae by Nannfeldt (**1932**). v. Höhnel (l.c.) gave an excellent description of this species.

On *Delphinium* sp., Boulder Lake, 4,500 ft. elev., May 27, 1939, (*13799*).

Hyalopeziza Pteridis sp. nov.

Apothecia minuta, solitaria, sessilia ad substipitata, 175–200 μ in diam., 75 μ alta (basi inclusa), cupuliformia, pellucida, hyalino-alba propter setas excipulares, 75 μ longa, 6 μ lata, asci cylindraceo-clavati, 30–35 × 4.5 μ, octospori; sporae virguliformes, rectae, hyalinae, unicellulae, 4–5.5 × 0.75–1 μ; paraphyses filiformes.

Ad caules vetustas *Pteridis* sp., Lake Quinault, Washington, 2 Junii, 1939, Smith No. *13987*, **Typus.**

Apothecia minute, solitary, sessile to substipitate, 175–200 μ in diam., 75 μ in height (including the base), cup-shaped, translucent, hyaline-white from the excipular hairs; exciple composed of small prismatic cells from which arise long, rough, hyaline, septate hairs 75 μ long, 6 μ at the widest (middle) portion; asci cylindric-clavate, 30–35 × 4.5 μ, eight-spored, spores obliquely arranged in the asci, ascus pore blue with iodine; spores rod-like, straight, hyaline, one-celled, 4–5.5 × 0.75–1 μ; paraphyses filiform.

The genus *Hyalopeziza* was established by Fuckel (1869–1870), but was emended by v. Höhnel (**1902**), and was placed in the Hyaloscyphaceae by Nannfeldt (**1932**). It is a small genus. Because of transfers only *H. ciliata* was left in the genus. Nannfeldt made no disposition of *H. caricis* Sacc., but neither *H. ciliata* nor *H. caricis* can be our North American fungus found on fern leaves. *H. ciliata* is said to have large spores and *H. caricis* is reported on *Carex* sp., turns olive black on drying, and has subcapitate hairs.

HYALOSCYPHA ALNISEDA Vel. Monog. Disco. Bohem., pt. 1, p. 283. 1932.

Apothecia minute, 0.1–0.3 mm. in diam., sessile, cup-shaped, substance soft, color pale watery-gray, margin fringed with a single row of one-celled hairs which are bulbous at the origins; asci 30–40 × 5 μ; spores 5–7 × 2 μ, straight to slightly bent, one-celled, hyaline; paraphyses filiform.

On *Alnus* log, Lake Ozette, May 15, 1939, (*13432*).

HYALOSCYPHA HYALINA (Fr.) Boud. Icon. Mycol. **3**, pl. 525. 1905–1910.

This minute fungus is scarcely visible to the unaided eye. When moist it is translucent; when dry it takes on a pale yellowish color. The apothecia are sessile and some are turbinate. The marginal hairs are one-celled, stiff, lance-shaped, and they project beyond the asci about 30 μ. The hyaline spores measure 4–6 × 1.5–2 μ, and the paraphyses are filiform.

On alder sticks, Kalaloch, May 2, 1939, (*13074*); on *Rubus* canes, Lower Hoh River, May 18, 1939, (*14542*).

HYSTEROGRAPHIUM PROMINENS (Phill. & Hark.) Berl. & Vogl. Syll. Fung. Additaments ad Volumina 1–4. 1886.

On madrone, Lake Crescent, May 26–June 15, 1939, (*13968, 13747, 13766* and *14360*). Identified by M. L. Lohman.

KARSCHIA LIGNYOTA (Fr.) Sacc. Syll. Fung. **8**: 779. 1889.

On *Acer* sp., Lake Crescent, June 13, 1939, (*14351*); on *Rubus* sp., Lake Crescent, June 13, 1939, (*14348*).

KARSCHIA MELASPILEOIDES Rehm. Ascomycetes: Hysteriaceen und Discomyceten. In Rabenh. Krypt. Fl. p. 347. 1890.

This fungus differs from *K. lignyota* in having smaller apothecia. The two-celled spores measure 14–16 × 5–6 μ as compared with 9–12 × 4–5 μ in *K. lignyota*. The apothecia do not turn wine red in iodine. The paraphyses are sparingly branched below the middle and their apices form an epithecium.

On *Populus trichocarpa* T. & G., Hoh River, May 7, 1939, (*13218, 13207*).

KARSCHIA STYGIA (B. & C.) Massee. Jour. Linn. Soc. **35**: 107. 1901. See Butler, p. 814. 1940.

On *Populus trichocarpa,* Hoh River, May 7, 1939, (*13207*).

Lachnaster miniatus sp. nov. (FIGS. 20–23)

Apothecia minuta, alba, 0.1 mm. lata, subsessilia, margo setis longis flagelliformibus praetextus, ad modum dentium dispositis; setae 75–90 × 6–8 μ, septatae, asperae, pallide luteae; asci 30–35 × 5–6 μ; sporae rectae, hyalinae, 6–8 × 1–1.5 μ, paraphyses hyalinae, lanciformes, 50 × 6–7 μ.

Ad *Pteridium aquilinum* (L.) Kuhn, Lake Crescent, Washington, 27 Maii, 1939, Smith No. *13760;* **Typus.**

Apothecia minute, 0.1 mm. broad, very short stipitate to substipitate, white, margin edged with long whip-lash hairs arranged in teeth, hairs 75–90 × 6–8 μ, septate, rough, pale yellow, the lower half broader, abruptly narrowing to the sharp pointed upper portion; asci 30–35 × 5–6 μ, eight-spored, pore blue with iodine; spores straight, hyaline, 6–8 × 1–1.5 μ arranged obliquely in the asci; paraphyses lance-like, hyaline, wider and longer than the asci, 50 × 6–7 μ.

On *Pteridium aquilinum,* Lake Crescent, Washington, May 27, 1939, Smith No. *13760*—Type. Additional collections (*13763* and *13976*).

The genus *Lachnaster* was described by v. Höhnel and is characterized by the marginal hairs of the apothecia being arranged in teeth and by the lance-like paraphyses.

LACHNUM ALBOTESTACEUM (Desm.) Karst. Myc. Fenn. **1**: 175. 1869–1870; Rehm, p. 903. 1893.

The specimens in our collections grew on grass. The apothecia are "vinaceous buff" when fresh, and become whitish in age. "Vinaceous brown" hairs cover the stipe and the outside of the apothecia. The hairs are pale at their apices. Iodine turns them rose lavender. The spores are 6–9 × 1.5 μ. The paraphyses are very long and are sharply pointed.

On grass, Hoh River, May 20, 1939, (*13625*); Hoh River, May 30, 1939, (*14735*).

LACHNUM ALNEUM Vel. Monogr. Disc. Bohem. p. 247. 1934.

Apothecia stipitate on very slender stipes, covered with hairs which are conspicuous by their roughened, spiny projections, hairs short, blunt, rigid; asci 35–40 × 4–5 μ; spores 6–8 × 1.5 μ; paraphyses up to 15 μ in the middle portion, lance-pointed, exceeding the asci by 35–40 μ, not numerous. This is the first report of this species from North America.

On log of *Alnus,* Lake Quinault, May 17, 1939, (*13502*).

LACHNUM BICOLOR (Fr.) Karst. Myc. Fenn. 1: 172. 1871; Rehm, p. 870. 1893.

On *Alnus,* Hoh River, May 7, 1939, (*13211*); on debris of alder, Sol Duc Park Trail, 4,000 ft. elev., June 20, 1939, (*14483*).

LACHNUM CALYCULAEFORME (Fr.) Karst. Myc. Fenn. 1: 178. 1871.

The color of the hymenium in fresh plants is "tilleul buff," and the exterior is "wood brown." On decorticated wood, Lake Crescent, June 3, 1939, (*14017*).

LACHNUM CLANDESTINUM (Fr.) Karst. Myc. Fenn. 1: 178. 1871.

This species has been frequently and widely collected on *Rubus* spp. although it is not restricted to that substratum. The long, rough, brown hairs with the conspicuous crystal formation at the tips together with the uniform spores (7–9 × 1–1.5 μ) are some of the characters which distinguish it.

On twigs of willow (?), Spruce, May 19, 1939, (*13583*); on woody stems of nettle, Port Ludlow, May 30, 1939, (*13995, 13901*); on *Acer circinatum,* May 30, 1939, (*13907*); on *Rubus* canes, June 13, 1939, (*14347*).

LACHNUM CORTICALE (Pers. ex Fr.) Nannf. Nova Acta Regiae Societatis Scientiarum Upsaliensis ser. IV. 8 No. 8. p. 265. 1932.

Nannfeldt has shown the above name is the tenable one for this fungus. It has previously been known under several other names;

among them are—*Peziza corticalis* Pers. and *Lachnella corticalis* (Pers.) Fr. Boudier (**1905–1910**) has an excellent illustration of it under the latter name. Velenovský (**1934**) described a species as *Lachnum corticale,* which name according to the International Rules of Nomenclature is invalid. The name **Lachnum bohemicum** nom. nov. is proposed.

On root of *Rubus* sp., Hoh River, May 7, 1939, (*13210*).

LACHNUM FLAVOFLOCCOSUM Rehm. Ann. Myc. **5**: 520. 1907.

The bright brown color of the apothecia is characteristic. The cups are sessile and gregarious. The spores are fusoid and measure 7–9 × 1.5 μ. The paraphyses are conspicuous, acutely lance-pointed and are unusually long. This species was described on *Lonicera* sp. from a collection made at Sumner, Washington, by E. T. and S. A. Harper, 1906.

On *Lonicera* sp., Cape Flattery, May 27, 1939, (*13794*).

LACHNUM FLAVO-FULIGINEUM (Fr.) Rehm, p. 888. 1888.

The brown hairs are very long and numerous on the outside of the cups, and they bear no crystals. The spores measure 9–10 × 2.5–3 μ.

On sticks, Lake Crescent, June 3, 1939, (*14033*); on *Sambucus* sp., Lower Elwha River, July 3, 1939, (*14746*).

LACHNUM GAULTHERIAE Zeller. Mycologia **26**: 292. 1934.

On leaves of *Gaultheria shallon* Pursh, Lake Crescent, June 2, 1939, (*13974*).

LACHNUM HYALINELLUM Rehm. Ann. Myc. **5**: 398. 1917.

On *Alnus* cones, Clearwater River, May 9, 1939, (*13288*); on wood, Jackson Guard Station, May 13, 1939, (*13389*); on sticks, Lake Quinault, May 17, 1939, (*13504, 13492*); on old conifer wood, Hoh River, May 18, 1939, (*13526*); on *Alnus* cones, Port Ludlow, May 30, 1939, (*13892*); on *Alnus* cones, Lake Crescent, June 2, 1939, (*13984*); on *Alnus* wood, Joyce, July 6, 1939, (*14841*).

This species is commonly collected. Rehm made a distinction between the fungus growing on the wood and on the fruits of *Fagus silvaticus*. For the fungus growing on the fruits he gave the name *forma fructicolum*. Our collections were made on the cones and on the wood of *Alnus* sp. They seem to be exactly alike and they differ only slightly from Rehm's description. The hairs are slightly roughened in contrast to the condition reported by Rehm. In view of the fact that the fungus as represented by our western collections does not seem to be differentiated on the basis of substratum, it may be found that the form distinction made by Rehm is not significant. The slight roughness on the hairs of the American material does not prevent its being named as above.

LACHNUM NARDI Rehm, p. 883. 1888.

This is a minute stipitate fungus with long, rough, septate hairs which at the margin of the apothecium are clustered in fascicles. The spores are small, and measure 5–7 × 1 μ. The paraphyses are broadly lanceolate and extend 30 μ beyond the asci. The hairs turn violet in iodine solution. This species is distinguished from others on sedges by its small spores. It resembles *L. carneolum* (Sacc.) Rehm which is reported on grass. Rehm gives the spore size as similar to *L. nardi* but the original description gives the spores as considerably larger in both length and width. The fungus is white when fresh.

On sedge, Lake Crescent, June 3, 1939, (*14035, 14023*); June 4, 1939, (*14067*).

LACHNUM NIVEUM (Fr.) Karst. Myc. Fenn. 1: 168. 1871.

The apothecia are short stipitate, and are covered with rough, hyaline hairs. The spores measure 6–8 × 1.5 μ. The paraphyses are lance-shaped. A peculiarity of the hairs is that they turn pale violet in iodine. Saccardo described *L. crystalligerum* from a specimen on *Rubus parviflorus* from Spokane, Washington, but the two species are distinct. In the latter species the hairs are tipped with large crystals and the asci and spores are considerably larger.

On *Rubus* sp., Kalaloch, April 27, 1939, (*13009*); June 13, 1939, (*14343*); Forks, June 18, 1939, (*14437, 14440*).

LACHNUM PALLIDE-ROSEUM (Saut.) Rehm, p. 885. 1893.

This is a delicate, stipitate plant with the hymenium "vinaceous buff" when fresh. On drying it becomes rose red. The outside of the cup is white from the short, rough hairs. The spores measure 7–10 × 1.5 μ. The paraphyses are very large, prominent and exceed the asci.

On grass stems, Hoh River, June 30, 1939, (*14722*).

LACHNUM SETIGERUM (Phill.) Rehm. Ann. Myc. **3**: 518. 1905.

This species was described from material collected in California on a species of *Aralia*. The apothecia are covered with stiff, brown, septate hairs the tips of which are nearly globose and nearly hyaline. The spores are straight and hyaline and measure 9–12 × 2 μ. The ascus pore is not blue in iodine.

On Devil's Club, Forks, May 31, 1939, (*13926*).

LACHNUM SPIRAEAECOLUM (Karst.) Rehm, p. 880. 1893.

On stems of nettle, Port Ludlow, May 30, 1939, (*13909*).

LACHNUM SULFUREUM (Fr.) Rehm, p. 891. 1893.

This species is found commonly and on a wide variety of substrata.

On herbaceous stems, Hoh River, May 18, 1939, (*13529*); on *Sambucus* sp., Forks, May 31, 1939, (*13935*); on stems of *Rubus* sp., Lake Crescent, June 13, 1939, (*14300, 14344*).

LACHNUM VIRGINEUM (Fr.) Karst. Myc. Fenn. **1**: 169. 1871.

Seven collections were made on sticks: Clearwater River, May 9, 1939, (*13287*); Kalaloch, May 10, 1939, (*13307*); Lower Hoh River, May 18, 1939, (*13537, 13539*); Lake Crescent, June 4, 1939, (*13985*); Lake Crescent, June 3, 1939, (*14034*); Sol Duc Park Trail, 4,000 ft. elev., June 20, 1939, (*14479*).

LAMPROSPORA CARBONARIA (Fuck.) Seaver. Mycologia **6**: 16. 1914; North American Cup-fungi, p. 67. 1928.

On burned soil, Olympic Hot Springs, May 28, 1939, (*13807*); on soil, Joyce, July 5, 1939, (*14799*).

LAMPROSPORA CREC'HQUERAULTII (Cr.) Boud. Icon. Mycol. **1905–1910**; Seaver, North American Cup-fungi, p. 62. 1928.

On wet soil, Lake Crescent, June 3, 1939, (*14022*).

LAMPROSPORA HAEMASTIGMA (Fr.) Seaver. Mycologia **6**: 17. 1914; Seaver, p. 68. 1928.

On soil, Spruce, May 19, 1939, (*13583*); on leaf content in dung, Spruce, May 19, 1939, (*13583*); on soil, Hoh River, June 30, 1939, (*14716*).

LAMPROSPORA LEIOCARPA (Curr.) Seaver. Mycologia **6**: 21. 1914; North American Cup-fungi, p. 73. 1928.

On burned soil, Mora, May 22, 1939, (*13667*); Olympic Hot Springs, May 28, 1939, (*13813*); Mora, May 31, 1939, (*13946*); Forks, May 31, 1939, (*13940*); Sol Duc River, May 31, 1939, (*13945*).

Number *13946* is an unusually large plant. When dry the disk measured 4.5 cm. in diameter.

LASIOBOLUS EQUINUS (Mull.) Karst. Act. Soc. Fauna Fl. Fenn. **2**: 122. 1885; Seaver, p. 155. 1928.

On elk dung, Kalaloch, April 29, 1939, (*13007*); May 2, 1939, (*13070, 13077*); on dung, Hoh River, May 20, 1939, (*13624*); on cow dung, Lake Crescent, May 22, 1939, (*13835*); on raccoon dung, Joyce, June 9, 1939, (*14220*); on dung, Cape Flattery, June 27, 1939, (*13782*).

LOPHODERMIUM PINASTRI (Fr.) Chev. Flora Paris **1**: 430. 1926; Rehm (**1887–1896**), p. 43. 1887.

On conifer twig, Lake Crescent, June 15, 1939, (*14382*).

MELASTIZA CHARTERI (W. G. Smith) Boud. Hist. Class Discom. Eur. p. 64. 1907; Boud. Icon. Mycogr. pl. 45, fig. 17. 1905–1910; Seaver, p. 103. 1928.

Apothecia bright red, color revives in water, delicate, hyphae-like hairs are short, blunt, thin-walled and are pale brown in color, sparse, and tend to become grouped into bundles; mature spores coarsely warted, apiculate, 18–20 × 10–12 μ; paraphyses slender, widening abruptly at the apices into clavate or bulbous swellings reaching 18 μ in diam.

On earth, Pyscht River, Sept. 25, 1935, (*2671*); Mt. Angeles, Sept. 28, 1939, (*17378*), collected by H. V. Smith. To the synonymy of this species as given by Seaver (**1928**) add: *Lachnea pseudotrechispora* Rehm, *Humariella pseudotrechispora* Schröter, and *Aleurina pseudotreichospora* (Schröter) v. Höhnel apud Rehm. There seems to be no difference between these and *Peziza charteri* W. G. Smith. The combination of the two characters—presence of hairs on the exciple together with the warty apiculate spores—prevents this fungus from being placed in any of the following genera: *Lachnea, Aleuria, Humaria* or *Humariella*. The collection from the Olympic National Park fits Seaver's description.

MELITTOSPORIUM SCHNABELIANUM (Rehm) v. Höhnel. Frag. zur Mycol. IX Mitt. nr. 450, p. 1518. 1909.

Disc erumpent, then flat, marginate, dark gray-purple, powdered with white particles, 0.5–1.5 mm. in diam., asci 120–150 × 9–12 μ, usually four-spored, ascus pore reddish purple in iodine; spores muriform, four-celled, 18–20 × 9–10 μ; paraphyses filiform. branched above, forming an epithecium.

On stick, Lake Crescent, June 3, 1939, (*14029*).

Rehm described this fungus under the name *Belonidium Schnabelianum* although he recognized that it did not properly belong in the genus *Belonidium*. The muriform spores together with the erumpent habit are characters of the genus *Melittosporium*. V. Höhnel (l.c.) pointed this out and made the transfer to that genus. Sydow and Saccardo (**1899**) proposed the name *Schnablia* for this species but v. Höhnel's treatment is preferred.

MICROPODIA PTERIDINA (Nyl.) Boud. Icon. Mycogr. 3. pl. 527. 1905–1910.

Apothecia minute, stipitate, 200 μ in diam., 100 μ in depth, excipular cells on the lower one-half of the cup arranged in scale-like triangular patches overlapping like shingles on a roof, color of the lower part of each scale light sordid brownish shading to nearly hyaline at the tips; margin bordered by similar cell groups, from twenty to twenty-five at the edge of each cup; stipe 40–50 μ in height by 40 μ in width; asci 25–30 × 4–5 μ; spores straight, hyaline, one-celled, 4–6 × 1–1.5 μ; paraphyses filiform.

On *Pteridium aquilinum* (L.) Kuhn, Forks, June 6, 1939, (*14147*).

This fungus was named *Peziza pteridina* by Nylander. It resembles a *Helotium* but it is much smaller in size of cup, asci and spores. Also the excipular cells are different from those found in *Helotium* spp. This is not *Peziza pteridina* Pers. ex Fr. which is described as a sessile plant.

MITRULA CUCULLATA (Batsch) Fr. Summ. veg. Scand. p. 337. 1849; Durand, p. 402. 1908.

On hemlock needles, Lake Quinault, Oct. 19, 1925, collected by C. H. Kauffman; on fir needles, La Push, Oct. 25, 1935, (*3336*). Identified by E. B. Mains.

MITRULA PHALLOIDES (Bull.) Chev. Flor. de Paris. 114. 1826.

On wet soil, Kalaloch, May 10, 1939, (*13301*). Identified by E. B. Mains.

MOLLISIA AMENTICOLA (Sacc.) Rehm. 1887–1896. p. 540. 1891.

The marginal hairs are palisade-like and are pale in color, whereas the excipular cells below are hexagonal, small and dark-colored. The spores measure 6–9 × 1.5–2.5 μ.

On cones of *Alnus* sp., Kalaloch, April 27, 1939, (*1258*).

MOLLISIA BENESUADA (Tul.) Phill. Manual Brit. Disco. p. 174, 1887.

This is one of the light-colored species. The spores measure 8–10 × 2–2.5 μ.

Kalaloch, May 10, 1939, (*13312*); on dead wet sticks, Jackson Guard Station, May 13, 1939, (*13381*); Lake Quinault, May 17, 1939, (*13501*); Cape Flattery, May 27, 1939, (*13789*); Port Ludlow, May 30, 1939, (*13893*); Lake Crescent, June 15, 1939, (*14387*).

MOLLISIA CAESPITICIA Karst. Myc. Fenn. 1: 188. 1871.

On sticks, Lower Hoh River, May 18, 1939, (*13531*); on *Alnus* sp., Boulder Lake, May 28, 1939, (*13810*); on sticks, Port Ludlow, May 30, 1939, (*13911*); on crabapple, Forks, June 18, 1939, (*14438*).

MOLLISIA CINEREA (Batsch.) Fr. Syst. Myc. 2: 142. 1823.

Queet's River, May 3, 1939, (*13094*); Hoh River, May 7, 1939, (*12314*); Clearwater River, May 9, 1939, (*13296*); Lake Ozette, May 16, 1939, (*13439, 13437*); Lower Hoh River, May 18, 1931, (*13540, 13546*); Graves Creek, May 25, 1939, (*13729, 13726*).

MOLLISIA COMPLICATULA Rehm. 1887–1896. p. 520. 1891.

Apothecia inrolled, brown-black in color; asci 50–60 × 6–7 μ; spores 9–12 × 2–2.5 μ.

On *Lonicera* sp., Cape Flattery, May 27, 1939, (*13794, 13788*).

Rehm described this species from a collection on *Lonicera* from the Tyrol.

MOLLISIA REVINCTA Karst. Myc. Fenn. 1: 195. 1871.

The apothecia are brownish on the outside, have a whitish margin and light gray hymenium. The spores measure 8–11 × 1.5–2 μ. Rehm (**1914**) mentioned a form *Rubi* on *Rubus idaeus* but he did not give a description. What he considered a difference other than a difference in substrata is not known. Our collections seem to be the typical variety and there is no essential difference between those found on herbaceous stems and those on *Rubus* canes.

On herbaceous stems, Hoh River, May 18, 1913, (*13523, 13528*). The following collections were from stems of *Rubus* sp., Kalaloch, May 2, 1939, (*13072*); Forks, June 18, 1939, (*14439*).

MORCHELLA CONICA Pers. ex Fr. Summa veg. Scand. 316. 1849; Seaver, p. 239. 1928.

Jackson Guard Station, May 13, 1939, (*13380*); Hoh River, June 6, 1939, (*14146*); Lake Angeles, June 25, 1939, (*14640*); Lake Angeles, June 28, 1939, (*14671*).

MORCHELLA CRASSIPES Fr. Syst. Myc. 2: 9. 1823; Seaver, p. 237. 1928.

Under spruce, Hoh River, May 19, 1939, (*13552*); in *Alnus* flat, Graves Creek, May 23, 1939, (*13693*).

MORCHELLA ESCULENTA Pers. ex Fr. Syst. Myc. 2: 6. 1823; Seaver, 1928. pl. 36. fig. 2.

Lake Angeles, June 25, 1939, (*13173*).

NIPTERA MELATEPHRA (Lasch) Rehm, p. 558. 1891.

On sedge, Lake Crescent, June 4, 1939, (*14068*). In the sense of Rehm this is a typical collection with large two-celled spores.

OCELLARIA AUREA (Tul.) Rehm, p. 134. 1888.

On *Salix* sp., Whiskey Creek Beach, Joyce, June 22, 1939, (*14554*).

OMBROPHILA FLAVENS Feltg. Pilz Flora. 1. Thiel. Ascom. Nacht. III. 76. 1903.

Apothecia single or scattered, sessile to substipitate, 1.5 mm. in diam., dull yellow to pallid yellow when fresh, drying darker, exciple slightly roughened; asci 70–75 × 7–8 μ, pore blue in iodine; spores one-celled, hyaline, containing large oil drops, (9)11–13 × 3–4 μ; paraphyses filiform.

On dead wood of *Salix* sp., Lake Crescent, June 3, 1939, (*14027*). This species was described from a collection on *Salix*. V. Höhnel

reported that there is but scanty material left in the type collection. However, from Feltgen's description it seems safe to assume that our fungus is his species.

OMBROPHILA LIMOSELLA (Karst.) Rehm, p. 476. 1891.

Kalaloch, April 23, 1939, (*13051*); on sticks, Kalaloch, May 2, 1939, (*13069*); on debris, Cape Flattery, May 27, 1939, (*13793*).

Ombrophila Lysichitonis sp. nov. (FIGS. 24–25)

Apothecia 3–6 mm. in diam., 3–6 mm. alta, subturbinata, albida ad griseo-rosea, mollia, gelatinosa; hypothecium praeter stratum gelatinosum magnis cellulis subglobosis, stratum excipulare pubescens; asci cylindracei, 125–150 × 9–10 μ; sporae ellipsoideae, 11–14 × 6–8 μ, unicellulae, hyalinae; paraphyses filiformes, plurimae.

Ad carnem circum fructos *Lysichitonis camtschatcensis* (L.) Schott., Kalaloch, Washington, 10 Maii, 1939, Smith No. *13299*, **Typus.**

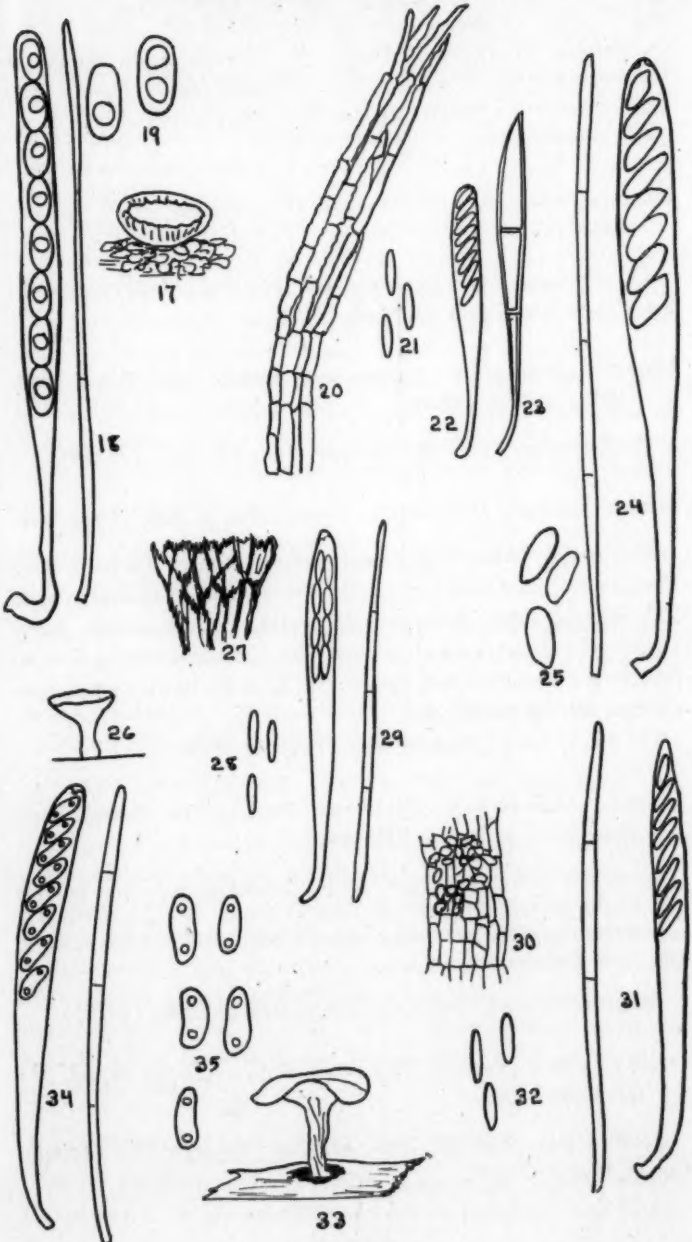
Apothecia 3–6 mm. in diam., 3–6 mm. high, subturbinate to short stipitate, stipe if present, short, thick, expanding broadly into the cup, white tinged grayish-pink, concolorous throughout, substance soft, gelatinous, a thin gelatinous layer lying directly below the hymenium: hypothecium other than the gelatinous layer made of large, loosely arranged subglobose cells, excipular layer embellished by a minute delicate pubescence made of the extension of the outermost layer of excipular cells which give a slightly velvety appearance; asci cylindric, 125–150 × 9–10 μ, frequently long-stalked, eight-spored, pore blue with iodine; spores 11–14 × 6–8 μ, hyaline, one-celled, inequilateral ellipsoid; paraphyses filiform, numerous, hyaline.

OMBROPHILA MICROSPORA (E. & E.) Sacc. & Syd. Syll. Fung. **14**: 187. 1899; Ellis, Bull. Torr. Bot. Cl. **24**: 282. 1871.

Apothecia "russet vinaceous" when fresh, up to 6 cm. in diam.; asci 70–80 × 6–7 μ, pore not blue with iodine; spores 5–6 × 2.5–3 μ.

On inner bark of *Populus trichocarpa*, Hoh River, May 7, 1939, (*13208*).

There are at least five other species of *Ombrophila* described in which the spores are small, but in each case there are morphological characters that prevent our fungus from being referred to any one of them. These small-spored species are *O. spelunarum* Legardo;



FIGS. 17–35.

O. violacea var. *rosiae* P. Henn.; *O. pellucida* A. L. Smith; *O. blumenavensis* P. Henn.; and *O. microsperma* P. Henn. Ellis (l.c.) called this a *Coryne* but the non-septate spores place it in the genus *Ombrophila*.

ORBILIA PARADOXA Vel. Monogr. Disc. Bohem., pt. 1. p. 102. 1934.

On *Alnus* log, Lake Quinault, May 17, 1939, (*13503*); on *Alnus* log, Elwha River, June 23, 1939, (*14594*).

OSTROPA CINEREA Fr. Summa veg. Scand. 1849; Rehm 1887–1896. p. 188. 1888.

On *Rubus* sp. (?), Lake Crescent, June 13, 1939, (*14350*).

OTIDEA ABIETINA (Fr.) Fuck. Symb. Myc. p. 330. 1869–1870.

This fungus is one of the older species which in the years since Persoon described it as a *Peziza* has been placed in several genera. The split apothecia determine its present position in the genus *Otidea*. It differs from *O. grandis* (Fr.) Rehm in having filiform paraphyses, slightly larger spores (18–22 × 10–12 μ), and apothecia that are lighter in color.

On muck, Lake Quinault, May 17, 1939, (*13506*).

OTIDEA CANTHARELLA (Fr.) Sacc. var. MINOR Boud. Icon. Mycogr. 2. pl. 326. 1905–1910.

Apothecia 1–3 cm. in diam., with a truncated top, split on one side, light colored; spores elliptical, smooth, 13–15 × (5)6–9 μ, containing two guttulae; paraphyses measuring 6–7 μ at their apices, and extending beyond the asci.

On gravel in road, Clearwater River, May 24, 1939, (*13738*).

OTIDEA FELINA (Pers. ex Fr.) sensu Bres. Iconogr. Mycol. **25**: taf. 1228. 1933.

Elwha River, Sept. 27, 1941, (*17338*); Olympic Hot Springs, Oct. 8, 1941, (*17699*).

In many respects these collections resemble *O. felina* sensu Bres. The chief difference is in the size of the apothecia. Our specimens measure up to 7–8 cm. in height and 7 cm. in width, whereas those described and illustrated by Bresadola (l.c.) are only 3–4.5 cm. in height and 2–3 cm. in width. Bresadola's interpretation of the species seems to be in marked contrast with Persoon's description which calls for a gray plant. Neither do any of the species put into synonymy by Bresadola agree too well with his description. Fries gave the name *Peziza leporina* var. *cinerea* to Persoon's fungus and hence followed Persoon in accepting the idea of grayness. Unfortunately we do not have color notes on fresh plants, but it is difficult to imagine that the pale ochraceous-buff color of the dried specimens was ever any shade of gray. For the present it seems best to place these data on record in the hope that further study will clear up the questions.

OTIDEA LEPORINA Fuck. Symb. Myc. p. 329. 1869–1870; Seaver, p. 85. 1928 (as *Scodellina leporina* (Batsch) S. F. Gray).

Lake Quinault, Oct. 13, 1925, collected by C. H. Kauffman and C. A. Brown; Bremerton, Oct. 26, 1942, collected by J. B. Flett.

OTIDEA PLEUROTA (Phill.) Sacc. Syll. Fung. **8**: 97. 1889; Rehm 1887–1896. p. 1028. 1894.

On soil, Lake Quinault, Oct. 21, 1925, collected by C. H. Kauffman.

This seems to be a new record for North America. The species is adequately described by Rehm (l.c.). It is distinguished from most species of *Otidea* by its dark brown color. The spores are rough and paraphyses are straight with clavate tips. The ascus pore shows a strong bluing reaction. *Otidea Smithii* Kanouse was described (Kanouse, **1939**) from specimens collected in California by A. H. Smith in 1937. This species is also dark brown in color but its paraphyses are strongly bent. The spores in *O. Smithii* are rough.

OTIDELLA FULGENS (Fr.) Sacc. Syll. Fung. **8**: 99. 1889.

Seaver (**1928**) placed this fungus in the genus *Pseudoplectania*. This seems to be an unnatural and forced position. The fungus

differs markedly from *P. melaena* (Fr.) Sacc. and *P. nigrella* (Fr.) Fuck. not only in its bright orange color but also in the near-absence of hairs on the exciple. At least seven other interpretations have been offered as to the generic position. According to the International Rules of Nomenclature Saccardo's combination is the valid name for those who regard the fungus as generically distinct from other Discomycetes.

On soil, Deer Lake Trail, 4,000 ft. elev., May 11, 1939, (*13331*); June 13, 1939, (*14312*).

PATELLARIA LECIDEOLA Fr. Summa veg. Scand. 151. 1849; Rehm, p. 330. 1890.

Apothecia small, thin, black, exciple composed of dark brown cells arranged over-lapping like shingles on a roof; asci six to eight-spored; spores four-celled, hyaline, 12–14 × 5–6 μ; paraphyses form a thick, brown epithecium.

On *Acer circinatum*, Olympic Hot Springs, June 5, 1939, (*14104*).

PATELLARIA SUBVELATA E. & E. Journ. Myc. 1: 252. 1885.

This species was described from material collected in Washington on a living conifer tree. Its outstanding character is the shape of the spores. They are clavate-fusoid, slightly curved and markedly pointed at one end. They are yellowish in color.

On decorticated sticks of fir, Lake Crescent, June 15, 1939, (*14388*).

PATELLEA CALIFORNICA Rehm, Ann. Myc. 10: 55. 1912.

This species was described from Southern California on dead *Adenostoma fasciculatum* Hook. & Arn. It has a minute, glabrous, black disc with two-celled hyaline spores, which measure 9–12 × 2–3 μ. The paraphyses are sparingly branched, colored and form an epithecium.

On madrone, Lake Crescent, May 27, 1939, (*13765*); June 2, 1939, (*13973, 13977*). It was also collected at Takilma, Ore., in 1925, on madrone by C. H. Kauffman and C. A. Brown.

PAXINA DUPAINII (Boud.) Seaver. North American Cup-fungi, p. 207. 1928.

On ground, Elwha River, June 10, 1939, (*14582*).

PAXINA HISPIDA (Schaeff.) Seaver. North American Cup-fungi, p. 205. 1928.

On ground, Elwha River, June 10, 1939, (*14262*); Marymere Falls, Lake Crescent, June 25, 1939, (*14657*).

PAXINA NIGRELLA Seaver. North American Cup-fungi, p. 208. 1928.

On hemlock branches on ground, Kalaloch, April 29, 1939, (*13004*); on decayed wood, Cape Flattery, May 27, 1939, (*13795*); Boulder Lake Trail, 4,500 ft. elev., May 28, 1939, (*13809*); Hoh River, May 19, 1939, (*14016, 13583*); Lake Crescent, June 3, 1939, (*14016*); on decorticated wood, Deer Lake Trail, June 13, 1939, (*14331*).

PAXINA MACROPUS (Fr.) Seaver. North American Cup-fungi, p. 203. 1928.

On humus flat, Lake Quinault, May 17, 1939, (*13489*); Hoh River, May 19, 1939, (*13583*); Lake Crescent, June 3, 1939, (*14016*); Elwha River, June 12, 1939, (*14282*).

PAXINA SUBCLAVIPES (Phill. & Ellis) Seaver. North American Cup-fungi, p. 206. 1928.

Lake Crescent, May 17, 1939, (*13505*).

PERROTIA FLAMMEA (Fr.) Boud. Hist. Class. Discom. Eu. 66. 1907.

On madrone, Lake Crescent, June 2, 1939, (*13978*).

PEZIZA BADIA Fr. Syst. Myc. 2: 46. 1823; Seaver, p. 221. 1928.

On soil and old wood, Hoh River, May 7, 1939, (*13174*); May 20, 1939, (*13622*); Graves Creek, May 25, 1939, (*13719*); Lake Quinault, Nov. 5, 1939, collected by C. A. Brown.

PEZIZA BRUNNEOATRA (Gill.) Seaver. North American Cup-fungi, p. 222. 1928.

On mossy debris on cottonwood logs, Hoh River, June 6, 1939, (*14152*); on soil, Hoh River, June 30, 1939, (*14713*); on wet soil, Joyce, July 5, 1939, (*14798*).

PEZIZA FIMETI (Fuck.) Seaver. North America Cup-fungi, p. 232. 1928.

On elk dung, Graves Creek, May 23, 1939, (*13720*); Elwha River, June 23, 1939, (*14595*).

In both of these collections the spores measure 18–20 × 9 μ which measurements are slightly larger than those given by Fuckel or by Seaver who report them to be 16 × 8 μ.

PEZIZA MELALEUCOIDES Seaver. North American Cup-fungi, p. 225. 1928.

This is a clear-cut species and is readily identified by Seaver's description. The nearly black hymenium and the small spores are two distinctive characters.

Deer Lake Trail, May 11, 1939, (*13332, 13377*); Boulder Lake Trail, May 28, 1939, (*13798*); on burned soil, Mora, May 31, 1939, (*13943*); on conifer log, Olympic Hot Springs, June 5, 1939, (*14086, 14645*); Deer Lake Trail, June 13, 1939, (*14320*); Hurricane Ridge, June 17, 1939, (*14420*); on soil, Heart O' Hills, June 19, 1939, (*14434*); Sol Duc Park Trail, June 20, 1939, (*14490*); on decayed wood, Hurricane Ridge, July 7, 1939, (*14857*).

PEZIZA PUSTULATA Fr. Syst. Myc. 2: 55. 1823; Seaver, p. 224. 1928.

On burned soil, Forks, May 11, 1939, (*13928*); on burned soil, Mora, May 22, 1939, (*13666, 13669*); on soil, Graves Creek, May 23, 1939, (*13722*).

PEZIZA REPANDA Fr. Syst. Myc. 2: 51. 1823; Seaver, p. 231. 1928.

On cottonwood log, Elwha River, June 8, 1939, (*14185*).

PEZIZA SYLVESTRIS (Boud.) Sacc. & Trott. Syll. Fung. **22**: 612. 1913; Seaver, p. 233. 1928.

On soil, Hoh River, June 6, 1939, (*14155*); Deer Lake, June 24, 1939, (*14616*); Sequim, July 7, 1939, (*14865*).

PEZIZA SEPIATRA Cke. Grev. **3**: 119. 1874.

This is a small fungus for the genus *Peziza*. It is broadly sessile to substipitate and measures 1.5 cm. or less in diameter. The margin is upraised. It is cinnamon brown throughout. The ascus pore is blue with iodine. The spores are smooth, hyaline, and measure 18–20 × 12 μ. This species has not been reported from the United States as far as can be determined.

On sandy roadside, Elwha River, June 12, 1939, (*14289*).

PEZIZA VIOLACEA Fr. Syst. Myc. **2**: 65. 1823; Seaver, p. 226. 1928.

On burned ground, Mora, May 22, 1939, (*13664*); Joyce, June 9, 1939, (*14225*).

PEZIZELLA MICROPSIS (Karst.) Sacc. Syll. Fung. **8**: 281. 1889; Rehm, p. 679. 1892.

Rehm gives a good description of this species. The fungus is small, sessile, white. On drying it becomes yellowish. The exciple is delicately pubescent. The asci measure 30 × 5–6 μ, and the spores are 6–8 × 1.5–2 μ.

On sedges, Lake Crescent, June 4, 1939, (*14069*).

PEZIZELLASTER RADIOSTRIATA (Feltg.) v. Höhnel. Ann. Myc. **15**: 349. 1917.

Apothecia minute, sessile, white, hymenium "light vinaceous buff," hairy, the marginal hairs hyaline, rough, arranged in definite teeth, the hymenial layer brown with iodine; asci eight-spored, 35–40 × 5–6 μ; spores 8–9(10) × 1.5 μ, hyaline, one-celled; paraphyses slender with pointed apices.

On old stems of nettle, Port Ludlow, May 30, 1939, (*13905, 13902*).

PSEUDOCIBORIA UMBRINA Kanouse. Mycologia **36**: 460. 1941.

This species was described from material collected on decayed *Alnus* leaves. The characteristic feature of the species is that there are two types of paraphyses—one type filamentous and hyaline and the other cylindric and dark brown.

Lake Crescent, June 3, 1939, (*18933*).

PHIALEA ALNIELLA (Nyl.) Sacc. Syll. Fung. **8**: 257. 1889.

This species seems to be very closely related to, if not identical with, *Helotium gemmarum* Boud., which has been reported on catkins of *Alnus glutinosa*. Both are described as being small stipitate fungi with a yellowish color in a portion of the stipes. Both have asci about 50 × 6 μ and spores that measure 6–9 × 2–3 μ. The species is a delicate plant and is probably better placed in the genus *Phialea* than in *Helotium*. Rehm placed *Hymenoscypha alniella* Schröt. in synonymy with *Phialea alniella*.

On maple seed, Elwha River, June 23, 1939, (*14597*).

Phialea cyathoidea var. **minutula** (Sacc.) comb. nov.

Saccardo described *Phialea minutula* and said of it that it could be distinguished from *P. cyathoidea* by its smaller asci and spores. He reported the measurements of the asci as 30–35 × 5 μ and the spores as 6–7 × 1.5 μ. According to Rehm, *P. cyathoidea* has asci and spores that measure 45–50 × 4.5–5.5 μ and 5–11 × 1 μ respectively. Our specimens have the measurements of those given by Saccardo for *P. minutula*. The two species are apparently closely related and in my estimation the specimens with the small spores and asci are at most but a variety of *P. cyathoidea*. The plant is stipitate, delicately scalloped at the margin and is white throughout.

On herbaceous stems, Lower Hoh River, May 18, 1939, (*13534*).

PHIALEA DISCRETA (Karst.) Rehm (**1887–1896**), p. *729*. 1893.

This is a fragile plant yellowish in color with asci that measure 40–50 × 4 μ and spores that measure 6–8 × 1.5–2 μ.

On gooseberry cane, Lake Crescent, June 13, 1939, (*14357*).

Phialea olympiana sp. nov. (FIGS. 26–29)

Apothecia gregaria, stipitata, 1 mm. in diam., firma, carnosa, "luteoso-citrina" in humido, exsiccanda nigricantia. Stipes gracilis, ad 1 mm. longus, levis, albus, ascoma stipesque rete hypharum nigro-brunneis incrustationibus extus striata. Margo pseudodentata. Hypothecium pseudoprosenchymaticum. Asci cylindracei 35–45 × 5 μ; sporae rectae, hyalinae, unicellulatae, 6–8 × 1 μ; paraphyses filiformes.

Ad caules herbarum, Forks, Washington, 6 Junii, 1939. Smith No. *14148*, **Typus.**

Apothecia gregarious, stipitate, 1 mm. in diam., firm fleshy, "yellowish citrine" when moist, drying blackish; stipe slender, up to 1 mm. long, smooth, hyaline white, the outside of the cup and stipe streaked with a rope-like net of hyphae with dark brown incrustations which give a black, glistening appearance in the dry condition. Margin pseudodentate from the incrustations; hypothecium pseudoprosenchymatic of small densely compacted interwoven hyphae which make almost a cellular appearance; asci cylindric, 35–45 × 5 μ, ascus pore not blue with iodine; spores cylindric, straight, hyaline, one-celled, 6–8 × 1 μ; paraphyses filiform.

This is a close relative of *P. cyathoidea,* but has smaller spores, larger asci and lacks the rose color in the apothecia. Without question many unanswered problems exist with regard to the genera *Helotium, Hymenoscypha* and *Phialea* and it is difficult to assign species accurately in the genus *Phialea* until some of these basic problems are solved and clear generic limitations established. Yet the two species described as new in this paper cannot be forced into any other known genera. They do not conform to the rather sturdy waxy fungi with fairly large spores and asci that are found in the genera *Helotium* and *Hymenoscypha.* They are soft, delicate plants with small spores and small asci. The delicate markings on the exterior of the cups in both species is a character rarely found in species of *Helotium.*

Phialea pallida sp. nov. (FIGS. 30–33)

Apothecia gregaria, stipitata, sine stromate, mollia, ceracea, 0.5 mm. in diam., 0.5 mm. alta, cupulata remanentia, margine erecto, in sicco involuto, pallide olivaceo-carnoso, in sicco flavido; stipes 200–300 μ longus, 150–200 μ in diam., apotheciis concolor, excipulum minute floccosum a cellulis melleis, minutis, subglobosis quae squamae simulant; asci cylindracei, 70–80 × 6–7 μ; sporae cylindraceae, apicibus acutis, 6–9 × 1.5 μ; paraphyses filiformes.

Ad caules vetustas *Delphinii* sp., Boulder Lake Trail, 28 Maii, 1939, Smith No. *13800,* **Typus.**

Apothecia gregarious, stipitate, without stroma, 0.5 mm. in diam., soft waxy, remaining cup-shaped with erect margin, inrolled when dry, "pale olive buff" when fresh, drying maize yellow; stipe smooth, 200–300 μ long by 150–200 μ wide, concolorous with the apothecium, composed of fine, rigid, parallel hyphae, expanding radially into the cup, exciple overcast with subglobose, honey-colored cell-like particles arranged in groups simulating triangular scales, 35–40 μ deep and as broad, producing a delicate floccose appearance, scales at margin of apothecia giving a crenate edge; hypothecium composed of fine, colorless interwoven hyphae; asci cylindric, 70–80 × 6–7 μ, eight-spored, pore turning blue with iodine; spores cylindric, with ends somewhat pointed, hyaline, one-celled, 6–9 × 1.5 μ; paraphyses filiform.

PROPOLIS FAGINEA (Schr.) Karst. Myc. Fenn. 1: 244. 1869–1870.

On conifer, Lake Crescent, Sept. 19, 1935, (*2278*); on *Lonicera*, Cape Flattery, May 27, 1939, (*13790*); on madrone, June 2, 1939, (*13986, 13980*); on fir, June 15, 1939, (*14378*); on madrone, June 15, 1939, (*14393*); on conifer, Heart O' Hills, June 19, 1939, (*14462*).

PROPOLIS LEONIA var. WEIRIANA Sacc. Nuovo Giorn. Bot. It. v. XXVII, p. 79. 1920.

The variety was described from material collected at Spokane, Washington, by J. R. Weir, and is distinguished from the typical variety by the large spores and the pale color of the apothecia.

On *Alnus* sp., Lake Crescent, June 15, 1939, (*14377*).

PSEUDOCOLLEMA CARTILAGINEUM Kanouse and Smith. Mycologia 32: 758. 1940.

On a heap of mouse dung, Deer Lake , July 10, 1939, (*14992*).

PSEUDOPLECTANIA NIGRELLA (Fr.) Fuck. Symb. Myc. p. 324. 1869–1870.

On dead wood in a swamp, Kalaloch, April 27, 1939, (*1257*); on soil, Hoh River, May 7, 1939, (*13216*); on moss on a rock, Jackson Guard Station, May 13, 1939, (*13396*); on decayed coniferous wood, Lower Hoh River, May 18, 1939, (*13546*).

PYRENOPEZIZA RUBI (Fr.) Rehm (**1887–1896**), p. 611. 1892.

A distinctive feature of this species is the dark speckled appearance of the exciple. The outermost layer is decorated with clumps of small, subspherical cells which resemble bunches of myxomycete spores. The hymenium is white to translucent gray. The asci measure 40–50 × 7 μ and the pore turns blue with iodine. The spores measure 9–10 × 1.5–2.5 μ.

On canes of *Rubus spectabilis* Pursh, Joyce, June 9, 1939, (*14226*); Lake Crescent, June 13, 1939, (*14356, 14346*).

PYRONEMA OMPHALODES (Fr.) Fuck. Symb. Myc. p. 324. 1869–1870; Seaver, p. 109. 1928.

On burned soil, Olympic Hot Springs, May 28, 1939, (*13806*).

RHIZINA INFLATA Karst. Act. Fauna Fl. **2**: 112. 1885; Seaver, p. 215. 1928.

On burned ground at base of cedar stumps, Lake Quinault, Oct. 24, 1925, collected by C. A. Brown; on burned ground, Mora, May 31, 1939, (*13934*).

RHIZOPODELLA MELASTOMA (Fr.) Richon. Catal. Rais. etc., Soc. Sci. et Arts, Vitry-le-François, XV, p. 191. 1889.

Lake Ozette, May 15, 1939, (*13420*); Lake Crescent, June 2, 1939, (*13988*); Lake Crescent, June 4, 1939, (*14065*); Mt. Angeles, June 28, 1939, (*14676*); Lake Angeles Trail, Sept. 19, 1941, (*17002*).

This fungus has been reported under several names as is shown by the lengthy synonymy given by Seaver (**1928**) under the name *Bulgaria melastoma* (Sow.) Seaver. He and others recognize that it is neither a true *Bulgaria* nor a good *Urnula*. The nature of the mycelial structure of the apothecia removes it from both of these genera. Richon (l.c.) raised Cooke's subgenus *Rhizopodella* to the status of a genus to accommodate Sowerby's species *Peziza melastoma*. Seaver (l.c.) did not mention Richon's disposition of the species. In correspondence with Nannfeldt about this species we find that we agree that Richon's position is the acceptable one

to follow. Nannfeldt has in preparation a paper upon the genus *Urnula* in which he proposes to clarify this situation.

Le Gal (**1946**) has investigated the manner of dehiscence in the asci of this species and has concluded that it belongs in the group Suboperculati of Discomycetes which she classifies as intermediate between Operculates and Inoperculates.

RHYTISMA PUNCTATUM Fr. Syst. Myc. 2: 696. 1823; Rehm (**1887–1896**), p. 83. 1888.

This species is distinguished from *R. acerinum* by its smaller asci and spores. The spores measure 40–50 × 7.5 μ which is about one half the length of those in *R. salicinum* Fr.

On leaves of *Acer macrophyllum*, Lake Crescent, June 2, 1939, (*13982*).

Rutstroemia microspora sp. nov. (FIGS. 33–35)

Apothecia solitaria ad gregaria, stipitata, ex stromate nigrum lenticulare oriunda; stroma 2 mm. in diam., in ligno putrido decorticato formatum, discus ad 9 mm., in sicco planus remanens, pallide ochraceus, in sicco brunneus; stipes ad 2.5 mm. longus, levis, albus, rugosus brunneusque in sicco; hypothecium a duobus stratis distinctis efformatum; asci cylindracei, 75–80 × 5–5.5 μ; sporae forma grani Tritici, 7–9 × 3–4 μ, hyalinae, unicellulae, biguttulatae, guttulae ad apices; paraphyses infrequentes, filiformes.

Ad ramulum vetustum, Forks, Washington, 29 Maii, 1939, Smith No. *13942*, **Typus.**

Apothecia solitary to gregarious, stipitate, arising from a black lens-shaped stroma; stroma 2 mm. in diam., formed in decayed decorticated wood, easily separable from the woody matrix, disk expanding up to 9 mm., remaining nearly flat on drying, "light buff" when fresh, drying brown; stipe up to 2.5 mm. in length, not enlarged at the point of insertion with the disk, smooth, drying wrinkled, white when fresh, drying brown, shining; hypothecium composed of two layers, a thin layer immediately beneath the hymenium composed of narrow, interwoven hyphae, the layer immediately beneath made of pseudoparenchymatic hyphae so densely packed that the individual cell-like portions cannot be distinguished; asci cylindric, 75–80 × 5–5.5 μ, eight-spored, the pore faintly blue with iodine; spores wheat-kernel in shape, 7–9 × 3–4 μ, hyaline, one-celled, a small oil drop located in each end; paraphyses scarce, filiform.

The presence of a stroma and woody substratum are two of the requisite characters for placing this fungus in the genus *Rutstroemia* as interpreted by White (**1941**). The firm texture is like that commonly found in species of *Rutstroemia*. The small asci and small spores distinguish it from other species described on wood substrata.

Sarcosphaera amplissima (Fr.) comb. nov. *Peziza amplissima* Fr. Summa veg. Scand. p. 349. 1849; Seaver (1942. pl. 46, as *Sarcosphaera coronaria*).

This species is known under several names, most common of which is *Sarcosphaera coronaria* (Fr.) Schroet. According to the International Rules of Nomenclature the Friesian name *Peziza amplissima* must be recognized and the valid name then becomes *Sarcosphaera amplissima*.

On ground, Mt. Angeles Trail, June 19, 1939, (*14441*); Sol Duc Trail, 3,000 ft. elev., June 20, 1939, (*14469*); Deer Lake Trail, June 24, 1939, (*14619*); Lake Angeles Trail, June 25, 1939, (*14646*).

SCLEROTINIA URNULA (Weinm.) Rehm, p. 804. 1893.

On fruits of *Vaccinum* sp., Kalaloch, May 10, 1939, (*13300, 13303*).

SPATHULARIA FLAVIDA Fr. Summa veg. Scand. p. 347. 1849.

Under fir, Joyce, Oct. 28, 1935, (*3384*); Crescent Beach, June 21, 1939, (*14521*). Identifications made by E. B. Mains.

STICTIS RADIATA (Pers.) Fr. Syst. Myc. **2**: 194. 1923.

On *Lonicera* sp., Cape Flattery, May 27, 1939, (*13791*); on madrone, Lake Crescent, May 29, 1939, (*13853, 13855*); on *Sambucus* sp., Forks, May 31, 1939, (*13939*); on sticks, Lake Crescent, June 1, 1939, (*14370*); on sticks, Lake Crescent, June 3, 1939, (*14021*); on sticks, Olympic Hot Springs, June 5, 1939, (*14093*).

STICTIS SERPENTARIA E. & E. Tor. Bot. Cl. **24**: 469. 1871.

This species was originally found in Washington on *Salix* sp. Our plants agree well with Ellis' description. The spores are loosely coiled in a serpentine manner when they become free from the asci.

On *Sambucus callicarpa* Greene, Port Ludlow, May 30, 1939, (*13904*).

TAPESIA CINERELLA Rehm. Hedw. **21**: 102. 1882.

On stems of *Gaultheria shallon* Pursh, Mora, May 22, 1931, (*13677*).

TAPESINA GRISEO-VITELLINUM (Fuck.) v. Höhnel. Frag. zur Mykol. Sitzb. der Akad. der Wissensch. Math.-Nat. Kl. Abt. 132. Bd. 4–8 Heft. 1923.

V. Höhnel emended the genus *Tapesina* and made Fuckel's *Velutaria griseo-vitellinum* the type of the genus. The fungus is characterized by a yellow-green color of the hymenium and a dark brownish exterior. The spores are four-celled.

On *Alnus* sp., Kalaloch, April 29, 1939, (*13008*); on twigs of hardwood, Lake Crescent, June 15, 1939, (*14390*).

TRYBLIDARIA WASHINGTONENSIS Kanouse. Mycologia **33**: 466. 1941.

On decorticate wood of *Chamaecyparis nootkatensis* and upon a foliose lichen (*Physia?*) growing upon the wood. Sol Duc Park Trail, June 26, 1939, (*14486, 14487*).

UNGUICULARIA SCRUPULOSA (Karst.) v. Höhnel. Mitt. Bot. Inst. Tech. Hochsch. Wien. 5. 1928.

This is a minute white, cup-shaped fungus, that grows on old wood. The margin of the cup is edged with hairs which are glistening and have a septum only at the base. Asci are 60–65 × 8 μ. The spores measure 9 × 3–4 μ. Both asci and spores are remarkably large for such small apothecia.

On old wood, Hoh River, May 13, 1939, (*13391*).

VELUTARIA RUFO-OLIVACEA (Pers. ex Fr.) Fuck. Symb. Myc. p. 300. 1869–1870.

On old stems, Clearwater River, May 9, 1939, (*13280*).

VERPA CONICA Fr. Syst. Myc. **2**: 24. 1823; Seaver, p. 245. 1928.

On ground under *Alnus* sp., Hoh River, May 7, 1939, (*13187*); on soil near snow bank, 4,800 ft. elev., Boulder Lake Trail, May 22, 1939, (*13823*).

VIBRISSEA TRUNCORUM Fr. Syst. Myc. **2**: 31. 1823; Durand, p. 452. 1908.

Kalaloch, May 2, 1939, (*13067*); on conifer sticks in stream, Hoh River, May 18, 1939, (*13524, 13530*); Forks, May 22, 1939, (*13680*); Sol Duc Park Trail, June 20, 1939, (*14491*). Identified by E. B. Mains.

XYLOGRAPHA ABIETINA (Pers.) Zahlb. Catalogus lichenum universalis **2**: 151. 1934.

On conifer log, Lake Angeles, June 25, 1939, (*14648*). Identified by M. L. Lohman.

XYLOGRAPHA SPILOMATICA (Anzi) Th. Fries. Lichenog. Scand. **1**: 639. 1874.

On dead conifer wood, Deer Lake Trail, June 13, 1939, (*14325*). When this fungus is fresh and moist it is very inconspicuous as it is the exact color of the wood upon which it grows. The asci are large and are thickened greatly at the apices. The opening of the mature asci seems to be caused by a swelling of a substance which, on expansion, tears the ascus open. The hypothecium is composed of small, subspherical, heavy-walled cells. The spores are one-celled and are biseriate. They measure 10–12 × 6–8 μ. The paraphyses form an epithecium.

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EXPLANATION OF FIGURES

FIGS. 1–3. *Ascophanus brunneus;* 1, an ascus and paraphyses; 2, two spores; 3, an apothecium × 5.

FIGS. 4–6. *Belonioscypha miniata;* 4, asci and paraphysis; 5, spores; 6, an apothecium.

FIGS. 7–9. *Discina olympiana;* 7, an ascus; 8, paraphyses; 9, spores.

FIGS. 10–12. *Discinella washingtonensis;* 10, an apothecium × 3; 11, spores; 12, an ascus and a paraphysis.

FIGS. 13–16. *Humaria stellata;* 13, top view of an apothecium; 14, an ascus and 2 paraphyses; 15, two spores; 16, two stellate hairs.

FIGS. 17–19. *Humarina washingtonensis;* 17, an apothecium; 18, an ascus and paraphysis; 19, two spores.

FIGS. 20–23. *Lachnaster miniatus;* 20, a group of hairs; 21, spores; 22, an ascus; 23, a paraphysis.

FIGS. 24–25. *Ombrophila Lysichitonis;* 24, an ascus and paraphysis; 25, spores.

FIGS. 26–29. *Phialea olympiana;* 26, an apothecium; 27, detail of rope-like net on exciple; 28, spores; 29, an ascus and paraphysis.

FIGS. 30–32. *Phialea pallida;* 30, sketch of excipular cells with adherent particles; 31, an ascus and a paraphysis; 32, spores.

FIGS. 33–35. *Rutstroemia microspora;* 33, an apothecium; 34, an ascus and paraphysis; 35, spores.

A NEW SPECIES OF CRISTULARIELLA ASSOCIATED WITH A LEAF SPOT OF MAPLE

ALMA M. WATERMAN AND RUSH P. MARSHALL[1]

(WITH 2 FIGURES)

In the summer of 1941 the writers observed the defoliation of a boxelder (*Acer negundo* L.) on the grounds of the Bartlett Tree Research Laboratories at Stamford, Connecticut. The foliage showed numerous target-like spots (FIG. 1, *A*) bearing very unusual fungus conidiophores. Collections of leaves of sugar maple (*A. saccharum* Marsh.) and sycamore maple (*A. pseudoplatanus* L.) with similar spots and conidiophores have since been received from New York and Pennsylvania.

The distinctive symptom of the disease on all the hosts is the yellowish gray spots, showing a series of light brown concentric rings on the upper leaf surface (FIG. 1, *B*) resulting in the target-like appearance. The spots are marginate, and vary in size, sometimes coalescing over large areas of the leaf surface. They are usually much larger on sugar maple than on the other two hosts On the under surface the spots are brown with no concentric rings On both surfaces of the spots, but more commonly on the lower surface, hyaline conidiophores with pyramidal heads (FIG. 2, *A*) may be present. The heads easily become detached from the stalks (FIG. 2, *B*) and therefore may not be readily observed. A search of mycological literature failed to reveal any description of a similar fungus but it corresponds in many respects morphologically and physiologically with *Cristulariella depraedans* (Cke.) Hoehn. as described by Bowen (1). Since the chief distinction between the two fungi lies in the branching of the conidiophore it

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seems advisable to emend the description of the monotypic genus *Cristulariella* to include both fungi and to describe the fungus with the pyramidal heads as a new species of that genus.[2] For the purpose of comparison of the two species an emended description of *C. depraedans,* corresponding with the studies of this species by von Hoehnel (2) and Bowen (1), is also given.

CRISTULARIELLA Hoehn. (Emended description)

Hyphae steriles repentes, hyalinae vel subhyalinae; hyphae fertiles hyalinae, assurgentes, septatae, solitariae, in capitulum compactum, multiramosum, cristulatum, globosum vel pyramidale terminantes; rami dense compacti, clavati vel subglobosi, unicellulares, repetite di- vel trichotome ramosi, ex apice inflato-globoso vel per partem superiorem hyphae fertilis in forma pyramidis orientes; conidia solitaria ad apices ramulorum ultimorum, globosa, hyalina, continua.

Sterile hyphae decumbent, hyaline or subhyaline; fertile hyphae hyaline, ascending, septate, solitary, terminating in a compact multibranched, cristulate, globose or pyramidal head; branches densely compact, clavate or subglobose, unicellular, repeatedly di- or trichotomously branched, arising either from an inflated-globose apex or along the upper part of the fertile hypha (conidiophore) in the form of a pyramid; conidia produced singly at the tips of the ultimate branches, globose, hyaline, continuous.

CRISTULARIELLA DEPRAEDANS (Cke.) Hoehn. Akad. der Wiss. Wien. Math.-Nat. Kl. Sitzber. **125** (Abt. 1): 124. 1916. Bowen, Conn. Agr. Exp. Bull. **316**: 635. 1930.

Syn.: *Polyactis depraedans* Cke. Jour. Quek. Micr. Club. S. II, **2**: 141–142. 1885.

Botrytis depraedans Sacc. Sacc. Syll. Fung. **4**: 134. 1886.
Illosporium diedickeanum Sacc. Ann. Mycol. **6**: 563. 1908.

Spots on leaves gray, definite or confluent, nonmarginate, epiphyllous; fertile hyphae amphigenous, usually epiphyllous, solitary, erect, hyaline, 100–270 μ long, 8–16 μ diam., usually 5-septate, terminal cell up to 28 μ wide, rounded with radiating compact branches

[2] The authors are indebted to Miss Edith K. Cash, Associate Mycologist, Division of Mycology and Disease Survey, Bureau of Plant Industry, Soils and Agricultural Engineering, for suggestions regarding the classification of the species and for assistance in the preparation of the Latin diagnoses.

forming a globose cristulate head, heads 100–150 μ in diam.; branches elliptic-clavate, unicellular, repeatedly di- or trichotomously branched; conidia produced singly at the tips of the ultimate branches, rare, minute, globose, hyaline, continuous, 2–4 μ diam.

Habitat: On living leaves of *Acer pseudoplatanus* in England (type of genus) and Germany; of *A. saccharum* and *A. saccharinum* L. in the United States.

Cristulariella pyramidalis sp. nov.

Maculis foliorum amphigenis, flavo-griseis vel fulvis, definitis, marginatis, subinde confluentibus, cuticula epiphylla concentrice elevata; hyphis fertilibus amphigenis, plerumque hypophyllis, hyalinis, solitariis, assurgentibus, 0.5–1 mm. longis, 12–16 μ diam., septatis, subinde ad septa leniter constrictis, parte superiori pyramidiformi, 250–450 μ longa, 80–120 μ diam., e ramis dense compactis composita, apice tenui acutiusculo; ramis compactis, subglobosis, unicellularibus, repetite di- vel trichotome ramosis; conidiis raris, solitariis, ad apices ramulorum ultimorum oriundis, minutis, globosis, hyalinis, continuis, 2–4 μ diam.

Spots on leaves yellowish gray, definite, occasionally confluent, marginate, amphigenous, cuticle of upper surface raised in concentric rings; fertile hyphae amphigenous, usually hypophyllous, hyaline, solitary, ascending, 0.5–1 mm. long, 12–16 μ diam., septate, sometimes slightly constricted at the septa, upper portion branched forming a pyramidal head, heads 250–450 μ long, 80–120 μ diam.; apex of fertile hypha, slender, more or less acute; branches compact, subglobose, repeatedly di- or trichotomously branched; conidia rare, solitary, produced at the tips of the ultimate branches, minute, globose, hyaline, continuous, 2–4 μ diam.

Habitat: on living leaves of *Acer negundo, A. saccharum,* and *A. pseudoplatanus* in Connecticut, New York and Pennsylvania.

Type specimen FP96300 on leaves of *A. negundo,* Stamford, Connecticut, collected by R. P. Marshall, July 24, 1941, has been deposited in the Mycological Collections, Plant Industry Station, Beltsville, Maryland; type collection specimens in the herbarium of the New York Botanical Garden, in Farlow Herbarium, Harvard University, Cambridge, Massachusetts, and in the Forest Pathology Laboratory, Bureau of Plant Industry, Soils and Agricultural Engineering, at New Haven, Connecticut. Specimens

FP96301 on *A. saccharum* and FP96302 on *A. pseudoplatanus* are also on file at the Forest Pathology Laboratory at New Haven.

Sections through the spots on which the conidiophores of *Cristulariella pyramidalis* were found showed the presence of a small amount of wide hyaline or subhyaline superficial hyphae on the upper surface from which the occasional conidiophores arose. Strands of narrower hyphae in small amounts were present in the epidermis of both leaf surfaces and occasionally between the mesophyll cells. Most of the epidermal cells of the upper surface were partially decomposed and, below the concentric rings in the cuticle, they were entirely missing with strands of hyphae conspicuous in these areas. The conidiophores found on the lower surface seemed to arise from the hyphae in the epidermis. Small superficial clusters of brown hyphal cells were scattered over the upper leaf surface of the spots but the relation of these to the epidermal hyphae could not be determined.

The slender conidiophores arise at right angles to the leaf surface and vary in height from 0.5 mm. to 1 mm. Each conidiophore is composed of a single septate central hypha, the lower cells of which are of uniform width, but the upper cells are usually of gradually decreasing width, tapering to a more or less acute apex (FIG. 2, *C*). Along the sides of these upper cells arise the characteristic subglobose lobed cells, which, by their continued acropetal growth and formation of di- and trichotomous uniseptate lobes, develop into a pyramidal head. Occasionally non-typical heads are found in which the central hypha has a muticate apex as illustrated by the lower conidiophore in figure 2, *B*, or is pinnate-branched with each lateral branch forming a pyramidal head. The typical heads measure approximately 250–450 μ in length and eventually become detached from the stalk by abstriction at the septum just below the lowest branches (FIG. 2, *B, D*). Late in the season the heads become subhyaline or light tan in color and occasionally small globose hyaline spores are produced singly on the tips of the outermost lobes, particularly on those of the lower portion of the head. These spores seem to be rare in nature and are easily detached. Other globose branches at the base of the head sometimes develop long septate branches (FIG. 2, *D*).

In Petri dish cultures on Leonian's medium (3) each spore produced at first a small ovoid cell, somewhat resembling the original spore in size and shape, from which one short germ tube developed but soon ceased to elongate (FIG. 2, *E*). The function of these spores was not determined but it is possible that they are microconidia. When the branched head of the conidiophore or a portion of a head was transferred from a leaf spot to agar, the lobed branches developed hyphae from which a white fluffy aerial mycelium was produced. Within about ten days numerous conidiophores were present among the aerial hyphae, each consisting of a single septate central hypha, much narrower than that produced in nature, bearing short flexuous branches along both sides of the upper cells. Small acrogenous solitary spores of the same size and character as those produced in nature were borne on the central hypha and on each of the branches (FIG. 2, *F*).

When transfers were made to culture tubes or flasks of Leonian's medium, in about two weeks a few small compact masses of hyaline hyphae were formed in the center of the culture on the inoculum block or along the edge of the medium near the glass of the tube or flask, or occasionally sparsely scattered over the surface of the medium. These masses gradually increased in size, with small globules of moisture adhering to the surface, which became brown and finally shining black, and formed definite sclerotia (FIG. 2, *G*). The sclerotia were more or less globose when growing singly, but occasionally several coalesced into knobby clusters. The rind was composed of brown, rather thin-walled palisade-like cells, two or three layers in thickness, covering the entire stroma except where the latter touched the glass. The medulla was white, consisting of wide, rather thick-walled hyphae which were closely interwoven just inside the rind, but more loosely arranged at the center. When first formed the sclerotia adhered rather firmly to the mycelial substrate but as the culture dried out they became easily detached. In some cases the small newly developed sclerotia became entirely overgrown with hyphae among which sporulating conidiophores were produced. The surface of the rind of such sclerotia remained gray because of the presence of the hyphae, but the rind itself was of characteristic texture. Sclerotia were produced only sparingly in all cases and none of them showed any further development.

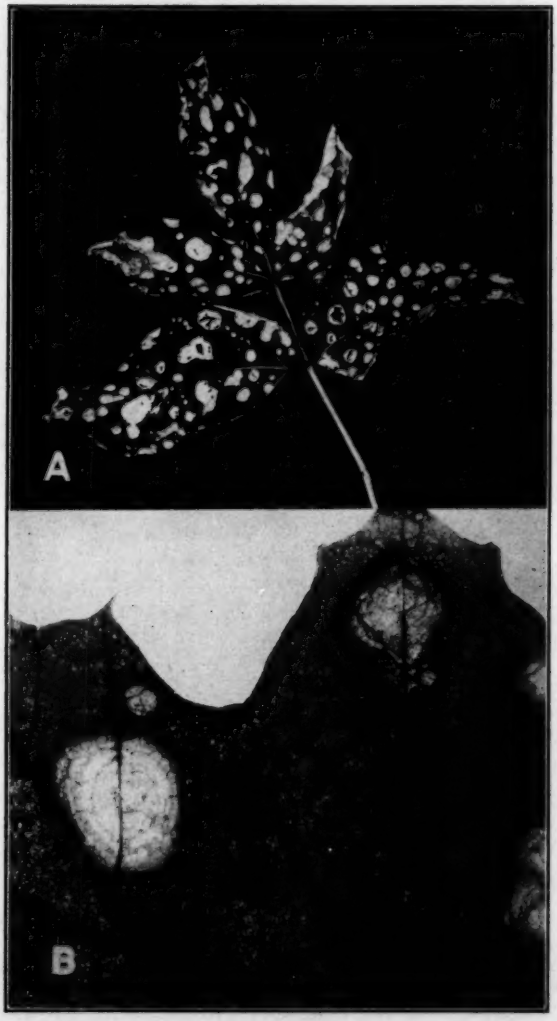

FIG. 1. Target-like leaf spots on which fertile hyphae of *Cristulariella pyramidalis* were found. A, boxelder leaf, slightly reduced; B, sugar maple leaf, × 1.5.

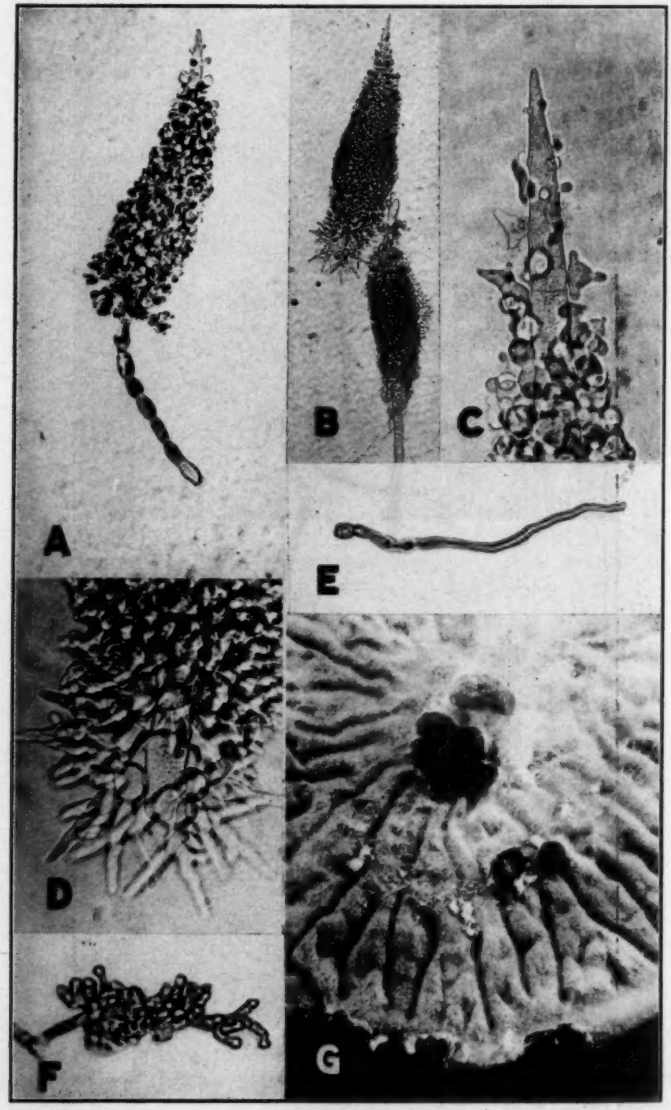

FIG. 2. A, fertile hypha of *Cristulariella pyramidalis* showing branched pyramidal head and septate stalk, × 160; B, heads of fertile hyphae—the

When the agar in the flask cultures was completely overgrown with mycelium and conidiophores the surface of the culture developed a definite convoluted or furrowed appearance (FIG. 2, *G*), which seemed to be characteristic of the species. When an isolate from boxelder and one from sugar maple were grown in the same flask a furrow was formed at first where the mycelia from the two isolates intermingled but the furrow was soon broken by cross furrows until the white surface took on the appearance of one uniform culture. As the cultures aged the mycelium in the flasks became grayish, and that in the test tubes a light tan resembling the color of the conidiophore heads in nature in late summer. The eight-sided crystals reported by Bowen (1) in agar cultures of *Cristulariella depraedans* were produced in great abundance in all cultures of *C. pyramidalis*.

The following summarizes briefly the characteristics of the two species of *Cristulariella* on the hosts and in culture, particularly in regard to the differences between the species:

Cristulariella depraedans. Hosts: *Acer pseudoplatanus, A. saccharum, A. saccharinum.* Leaf spots gray, definite or confluent, non-marginate. Fertile hypha on leaf spot erect, septate, terminal cell rounded with radiating compact branches, repeatedly di- or trichotomously branched, forming a globose cristulate head; in culture usually uniseptate, with globular terminal cell bearing a small loosely compact cluster of basidium-like branches at the tips of which are produced small globose spores 2–3 μ in diameter. Aerial hyphae in culture slow-growing, white, fluffy; an abundance of eight-sided crystals formed in agar media. Black sclerotia produced in culture, at first small, spherical, later merging into a mat.

Cristulariella pyramidalis. Hosts: *Acer negundo, A. pseudoplatanus, A. saccharum.* Leaf spots yellowish gray, definite, sometimes confluent, marginate; cuticle of upper leaf surface of spots slightly raised in brown concentric rings. Fertile hypha on leaf

upper one having been abstricted from the stalk, × 65; C, tip of fertile hypha with di- and trichotomous lobed branches, × 386; D, base of head of fertile hypha with long septate branches, × 386. E, germinating spore, × 386; F, fertile hypha produced in culture, × 386; G, portion of mycelial mat on agar in flask culture, showing surface convolutions and sclerotia, × 1.5.

spot erect, septate, upper portion branched forming a pyramidal head; apex slender, more or less acute, branches compact, repeatedly di- or trichotomously branched; in culture slender, several-septate, with short flexuous basidium-like branches forming an irregular pyramidal head; central hypha and branches producing at the tips small globose spores 2–3 μ in diameter. Aerial hyphae in culture slow-growing, white, fluffy; surface becoming furrowed in older cultures; eight-sided crystals formed in abundance in agar media. Black sclerotia produced in culture small, spherical, solitary or coalescing in small groups.

The parasitism of *Cristulariella pyramidalis* and the relative susceptibility of species of *Acer* to this disease have not been determined. *Acer saccharum* and *A. pseudoplatanus* have been reported as hosts for both species of *Cristulariella*. Pirone (**4**, p. 251) illustrated a leaf spot on *A. pseudoplatanus* resembling that with which the writers have found *C. pyramidalis* to be associated. He designated it as "bull's eye spot" on several species of maple growing in shady places in the eastern United States and stated that the causal organism had been described as *C. depraedans*. This latter species, however, forms an entirely different type of spot without the distinct bull's eye appearance. It has been adequately described by Bowen (**1**), who proved the parasitism of *C. depraedans* by inoculations with mycelium and with spore suspensions. The source of inoculum for early spring infection, however, was not determined. No sclerotia of either species of *Cristulariella* have been found as yet on fallen leaves and no ascigerous stage is known. A further study of the life history of the two species is desirable.

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THE RELATION OF THIAMIN TO THE PRODUCTION OF PERITHECIA BY CERATOSTOMELLA FIMBRIATA [1]

H. L. Barnett and Virgil Greene Lilly

It is a well established fact that many fungi are unable to synthesize certain necessary vitamins, or are capable of only limited synthesis. If normal vegetative growth is to result, these vitamins must be supplied by the medium in or on which these fungi grow. In contrast with our knowledge of the dependence upon vitamins for normal vegetative growth, little is known regarding the relation of these vitamins to sexual reproduction in fungi. Robbins and Ma (**6**) postulated that the formation of sex organs by various vitamin-deficient fungi would be found to be associated with the specific vitamin for which a fungus is deficient. Barnett and Lilly (**1**) have recently shown that, for *Sordaria fimicola*, a sufficient amount of biotin in the medium is necessary for (a) normal vegetative growth, (b) the production of perithecia and (c) the formation of normal mature ascospores, and that the amount of biotin required increases in the above order. The number of mature ascospores formed by this fungus was directly proportional to the amount (sub-optimal) of biotin added to the medium. Hawker (**3**), working primarily with *Melanospora destruens*, reported that an exogenous source of biotin was necessary for abundant mycelial growth and that fruiting occurred only on the further addition of thiamin.

Ceratostomella fimbriata (Ellis and Halst.) Elliott was reported by Robbins and Ma (**5**) to be highly deficient for thiamin and, under their conditions at 20° C., to have lesser deficiencies for biotin and pyridoxine. The effect of these vitamins upon the sexual reproduction of *C. fimbriata* was not reported. In the light of the above-mentioned work with *S. fimicola*, it was believed

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possible that thiamin might have a direct effect upon the sexual reproduction of *C. fimbriata*. The purpose of this paper is to report the results of investigations to determine the influence of thiamin upon the formation of perithecia by this fungus.

MATERIALS AND METHODS

The isolate of *C. fimbriata* used throughout these investigations originated from a diseased sweet potato obtained from a local grocery. Perithecia, ascospores and conidia were formed in abundance on two per cent malt extract agar which was used as stock culture medium. Various culture vessels were used, depending upon convenience and the nature of the experiment. In experiments where the weight of the mycelium was desired, 250 ml. Erlenmeyer flasks, previously cleaned with sulfuric acid-dichromate solution and containing 25 ml. of liquid medium, were used. Replicates of eight to twelve flasks were inoculated so that frequent harvests of duplicate cultures could be made at desired intervals. Other experiments were conducted in test tubes or in Petri dishes containing approximately 20 ml. of agar medium.

The basal medium, which has proven very satisfactory for vitamin study in this laboratory, had the following composition:

Glucose	25 g.
Casein hydrolysate equivalent to	2 g. casein
Fumaric acid	1.32 g.
KH_2PO_4	1.0 g.
$MgSO_4 \cdot 7H_2O$	0.5 g.
Na_2CO_3	1.1 g.
Fe^{+++}	0.2 mg.
Zn^{++}	0.2 mg.
Mn^{++}	0.1 mg.
Double distilled water to make	1000 ml.

The details of the preparation of the casein hydrolysate and the medium are described by Leonian and Lilly (**4**). The basal medium was treated with Norit before adding the minor elements. The pH was adjusted to 6.5 and the desired amounts of thiamin added before autoclaving. After autoclaving the pH was approximately 6.0. For convenience and uniformity throughout the paper, the amounts of vitamins are expressed in terms of micrograms (μg.) per liter. For use in tubes and plates the medium was solidified with agar which had been leached with five per cent

pyridine (2). A suspension of ascospores and conidia in distilled water was used as inoculum throughout these investigations. All cultures were incubated at 25 ± 1° C., except in one experiment specifically mentioned in the text.

VITAMIN DEFICIENCY

In testing this isolate of *C. fimbriata* for vitamin deficiencies the amounts of each vitamin per liter of medium were as follows: thiamin, 100 μg.; biotin, 5 μg.; pyridoxine, 100 μg.; inositol, 5000 μg. These vitamins were tested singly and in combination with thiamin. The dry weights expressed in milligrams of mycelium at the end of eleven days of incubation in the various media were as follows: control, 1.6; thiamin, 123; biotin, 0.3; pyridoxine, 0.3; inositol, 0.3; thiamin and pyridoxine, 124; thiamin and inositol, 121; thiamin and biotin, 124; thiamin, pyridoxine and biotin, 120; thiamin, pyridoxine and inositol, 121; thiamin, inositol and biotin, 116; thiamin, pyridoxine, biotin and inositol, 120. Nearly all of the mycelial growth was at the surface of the medium and all cultures containing thiamin were producing perithecia at the end of six days. The weights of all mycelia grown in media containing thiamin, regardless of the presence of other vitamins, were remarkably uniform. The cultures without thiamin made only a trace of growth. The eleven-day period of incubation allowed ample time for perithecia to be formed in all cultures and for the mycelium in liquid media to reach nearly maximum weight. From these results we may conclude that, under the conditions of these experiments, this isolate of *C. fimbriata* is completely deficient for thiamin, and that it shows no deficiency for biotin, pyridoxine or inositol. The deficiency for thiamin alone was also verified at a temperature of 19° C. No perithecia in any stage of development were formed at this temperature up to sixty days.

THE EFFECTS OF VARYING AMOUNTS OF THIAMIN

After the deficiency for thiamin had been established for this isolate, the effects of sub-optimal concentrations of thiamin were studied. Eight lots of liquid media containing varying amounts of thiamin (from 100 to 0.8 μg. per liter) were prepared and a

portion of each lot was solidified with agar. The effects of these concentrations of thiamin were observed upon (a) the radial extension of the mycelium on agar, (b) the dry weight of mycelium produced in liquid media, and (c) the formation of perithecia under both conditions. Basic agar medium without added thiamin was used as a control. These cultures were also compared with others on two per cent malt extract agar. Data recorded on

TABLE I

COMPARISON OF RADIAL GROWTH ON AGAR AND DRY WEIGHT OF MYCELIUM PRODUCED IN LIQUID MEDIA CONTAINING VARYING AMOUNTS OF THIAMIN. All cultures eleven days old.

μg. Thiamin per Liter	Liquid Media		Agar Media	
	Mg. Mycelium	Abundance of Perithecia	Diameter of Colony in Mm.	Abundance of Perithecia
none	trace of growth	none	39*	none
0.8	19	none	44	none
1.56	23	none	45	none
3.12	37	few	42	few
6.25	61	numerous	43	several
12.5	90	abundant	43	numerous
25	108	very abundant	46	abundant
50	114	very abundant	50	very abundant
100	111	very abundant	50	very abundant
2% malt extract (no thiamin added)	36	numerous	47	numerous

* The mycelium was so sparse that it was scarcely visible.

eleven-day old cultures are presented in Table I. Perithecia were judged to be present when the perithecial beaks could be seen above the mycelium with the aid of a hand lens. This means that only mature perithecia were recorded. In all cultures where fully formed perithecia were present, ascospores were also being extruded. Since it proved extremely difficult to make counts of perithecia with any degree of accuracy, only an estimate of the comparative abundance of perithecia can be given.

After eleven days of incubation the diameter growth of the mycelium was 50, 39 and 47 mm. respectively on medium containing the highest concentration of thiamin, medium with no added thiamin, and on two per cent malt extract agar. On the media containing high thiamin, the mycelial mat was rather thick and dense, and the submerged mycelium was quite dark. On the plates with low thiamin the mycelium was sparse, thin and lighter in color. In the control plates (no added thiamin) the mycelium had extended radially nearly as far as on the media containing thiamin, but it was so sparse that it was scarcely visible. Considering the much greater total growth in the cultures with thiamin, it is surprising that the radial extension on medium without added thiamin was so great. The dry weights of mycelia grown for the same period in liquid media showed only a trace of growth (estimated as 0.5 mg.) in the control, while 111 mg. of mycelium was produced in the flasks containing 100 μg. of thiamin per liter. Below 25 μg. of thiamin, the amount of mycelium produced was in proportion to the amount of thiamin present.

Perithecia were numerous to abundant on all plates containing between 25 to 100 μg. of thiamin per liter, whereas no perithecia were formed when the thiamin concentration was less than 3.12 μg. At the 6.25 μg. concentration the perithecia are clustered near the point of inoculation. The critical concentration required for the production of perithecia on agar medium containing the standard supply of nutrients seemed to be near 3 μg. per liter. There were significantly fewer perithecia produced on two per cent malt extract agar than on the casein-hydrolysate medium containing high concentrations of thiamin. In liquid media the results were very similar, perithecia being formed in the medium containing 3.12 μg. of thiamin.

The amount of thiamin in the medium had no apparent influence upon the abundance of conidia, except in so far as it affected the amount of mycelium produced.

THE EFFECTS OF ADDING THIAMIN TO THIAMIN-STARVED MYCELIUM

The results of the above experiments have raised the question as to whether the failure to produce perithecia in low concentrations of thiamin was due directly to an insufficient supply of thia-

min, or whether, because of the limited growth of the mycelium, it lacked sufficient vigor to produce perithecia. In an attempt to answer this question, discs of agar and mycelium were transferred from plates having no thiamin, but containing the full amount of nutrients, to tubes of each of the following: (a) distilled water; (b) distilled water and thiamin; (c) distilled water and purified agar; (d) distilled water, thiamin and purified agar.

Mature perithecia discharging ascospores were formed within six days in all tubes containing thiamin (with the exception of a few in which the inoculum was completely submerged in liquid), whereas no perithecia were developed in any tubes which lacked thiamin. The presence of the agar had no visible effect either upon the slight growth of the mycelium or upon the production of perithecia. This experiment was repeated several times with identical results. The transfer of mycelium grown in liquid medium containing 0.8 μg. of thiamin likewise gave the same results.

Since these four media (mentioned directly above) contained no nutrients, the growth of the mycelium in them was very scanty. Thus, the formation of the perithecia, which sometimes occurred on the new growth of the mycelium, was not conditioned by the vigor of the mycelium. Since the thiamin-starved mycelium produced perithecia when and only when transferred to media high in thiamin, regardless of the amount of nutrients, it seems logical to conclude that the presence of a sufficient amount of thiamin, over and above that required for vegetative growth, is essential to the formation of perithecia.

THE EFFECTS OF VARYING CONCENTRATIONS OF THIAMIN AND NUTRIENTS

To determine whether growth in a medium with a reduced supply of nutrients would influence the production of perithecia, a series of dilutions was prepared from the standard medium minus thiamin. Each of four series contained the undiluted medium and the following dilutions of nutrients: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$ and $\frac{1}{64}$. Thiamin was then added to the four series at the rates of 100, 6.25, 1.56 and 0.8 μg. per liter. The undiluted standard medium without thiamin served as control. Replicates of eight flasks for each combination of thiamin and nutrients were used. Four harvests of

two flasks each from each combination of treatments were made on the fifth, eighth, eleventh and fourteenth days of incubation. The mycelium was removed from the flasks, dried and weighed. Estimates of the relative abundance of perithecia were made on the fifth and eleventh days. The data taken on the eleventh day of incubation are presented in Table II.

TABLE II

DRY WEIGHTS IN MILLIGRAMS AND ESTIMATED ABUNDANCE OF PERITHECIA IN ELEVEN-DAY OLD LIQUID CULTURES WITH VARYING AMOUNTS OF THIAMIN AND NUTRIENTS. Control flasks showed only traces of growth with no perithecia and are not included.

μg. of Thiamin per Liter	Dilution of Nutrients in Medium						
	1/64	1/32	1/16	1/8	1/4	1/2	Undiluted
100	2 ++	3 +++	10 ++++	19 ++++	33 ++++	61 ++++	110 ++++
6.25	2 ++	5 +++	9 ++++	21 ++++	36 ++++	53 ++	59 ++
1.56	2 +	3 +++	10 ++++	11 ++++	17 ++	26 +	30 0
0.8	3 +	6 ++	9 +++	11 +	14 0	17 0	18 0

0 = no perithecia.
\+ = less than 20 perithecia per flask.
++ = 20–200 perithecia per flask.
+++ = 200–1000 perithecia per flask.
++++ = more than 1000 perithecia per flask.

In the presence of 100 μg. of thiamin per liter (near the optimum under our conditions), the amount of growth was in direct proportion to the amount of nutrients present. As the amount of thiamin was decreased and the nutrients kept high (undiluted medium to ¼ dilution) there was a significant decrease in the weights of the mycelium produced. However, in a limited supply of nutrients (1/16 to 1/64 dilution) the decrease in the amount of thiamin added had no effect upon the final weight of the mycelium.

Perithecia were formed in all flasks in which the nutrients were greatly reduced (⅛ to 1/64 dilutions) in all concentrations of thiamin, even though some of these cultures produced as little as 2 mg. of mycelium after eleven days of incubation. In a plentiful supply of nutrients (undiluted medium to ¼ dilution), the numbers of

perithecia were influenced directly by the amount of thiamin in the medium, none being formed in the presence of 0.8 μg. of thiamin, even though as much as 18 mg. of mycelium per flask was produced. Likewise, cultures in undiluted medium with 1.56 μg. of thiamin produced 30 mg. of mycelium but formed no perithecia.

Mature ascospores were present in all of the above-mentioned cultures which produced perithecia. No condition was found which induced the production of fully formed perithecia without the formation of ascospores. Very small immature perithecia were discovered by microscopic examination in some cultures with very low thiamin and high nutrient content, and in which no mature perithecia developed. Their development was apparently arrested by the lack of sufficient thiamin before the formation of beaks or asci.

We may summarize the conclusions to be drawn from the data presented in Table II as follows: (a) other conditions being equal, the formation of perithecia requires the presence of more thiamin than does mycelial growth; (b) the presence or absence of perithecia is determined by the amount of thiamin in relation to the amount of nutrients in the medium; (c) the abundance of perithecia is influenced by the amount of nutrients and by the amount of thiamin present in the medium.

DISCUSSION

The failure of *C. fimbriata* to form perithecia on media containing sufficient nutrients but very low in thiamin might, on first thought, be interpreted as being due to a general disturbance of some physiological processes, resulting in the inability to produce mycelium vigorous enough to support sexual reproduction. This was the interpretation presented by Robbins and Ma (**6**) to explain the failure of *C. pluriannulata* to form perithecia on medium lacking thiamin, even though "the fungus grew fairly well on media containing pyridoxine, or both pyridoxine and biotin." These authors report that *C. pluriannulata* is completely deficient for pyridoxine and partially deficient for thiamin.

In the light of the results obtained in the above experiments such an explanation for the failure of *C. fimbriata* to produce perithecia

in certain media cannot be justified. Perithecia were formed in flasks of the 1/64 dilution of nutrients and the 1.56 μg. concentration of thiamin, in which the final weight of mycelium was but 2 mg. No perithecia were present in the undiluted medium with the same amount of thiamin, although 30 mg. of mycelium per flask were produced in eleven days. Likewise, when transfers of thiamin-starved mycelium were made to media high in thiamin but without nutrients, perithecia were formed readily, without significant additional mycelial growth.

We may, therefore, conclude (a) that a minimum amount of thiamin in the medium is essential to the formation of perithecia by *C. fimbriata,* even though lesser amounts of thiamin permit fair mycelial growth, and (b) that the influence of thiamin upon the formation of perithecia appears to be direct, rather than acting through the general disturbance of the metabolism of this fungus. Whether perithecia will be formed on a certain medium is determined (other conditions being favorable) by the amount of thiamin relative to the amount of nutrients in the medium. The abundance of perithecia is conditioned both by the amount of thiamin and the amount of nutrients. The directness of the effect of thiamin is still open for discussion, since we know too little about the metabolic processes in fungi. However, it is clear that sub-optimal concentrations of thiamin cause a greater and more direct effect upon sexual reproduction than upon vegetative growth or the formation of conidia.

The conclusions reached regarding the relation of thiamin to the production of perithecia by *C. fimbriata* are strikingly similar to those previously reported (1) with regard to the relation of biotin to sexual reproduction of *Sordaria fimicola.* This suggests the possibility that perhaps these general conclusions apply equally well to other fungi deficient for these or other vitamins. Further investigations along this line are underway.

SUMMARY

The isolate of *C. fimbriata* used throughout these experiments was found to be completely deficient for thiamin and to show no deficiency for biotin, pyridoxine or inositol.

By keeping the amount of nutrients constant and high, and by reducing the amount of thiamin added to the medium, the formation of perithecia was inhibited.

The dry weight of mycelium produced in liquid media with varying thiamin content is compared with the diameter growth on the same media solidified with purified agar. The effects of these media upon the formation of perithecia are also given.

Thiamin-starved mycelium formed perithecia when and only when transferred to distilled water (or distilled water and agar) plus thiamin. Distilled water without thiamin was without effect.

Evidence is presented which leads to the conclusion that sexual reproduction occurs only when the ratio of thiamin to the amount of nutrients in the medium is relatively high.

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TRICHOMONASCUS, A NEW GENUS AMONG SIMPLE ASCOMYCETES [1]

H. S. JACKSON [2]

(WITH 20 FIGURES)

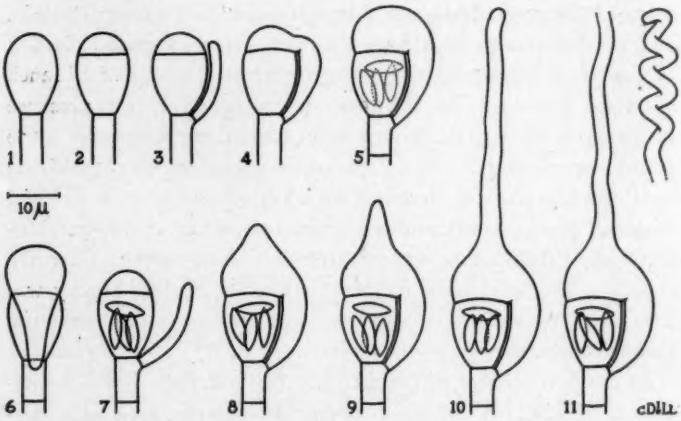
The fungus to be described was encountered while identifying a miscellaneous collection of Thelephoraceae made during the summer of 1939 in the Timagami Forest Reserve in Northern Ontario. In a crushed mount made from the hymenium of a small collection of *Corticium confluens* Fr., found growing on the bark of a branch of *Abies balsamea,* my attention was attracted to the presence of a simple Ascomycete having such unusual characteristics as to justify special study. This Ascomycete appears to be parasitic on the Corticium and was present in sufficient amount that the essential stages of development could be determined without difficulty. Unfortunately the fungus was discovered several months after the collection had been dried and no study of the nuclear history was possible. Attempts to culture the fungus from this dried material resulted in failure.

In the development of the ascocarp the first stage is the formation of an ellipsoid cell which is cut off from the apex of an upright hyphal carpophore 4–4.5 μ broad, which emerges to the surface of the hymenium of the Corticium. This ellipsoid cell (FIG. 1), when fully formed, is about 15 $\times$ 10 μ, and is an ascogonial mother cell, as is shown by its subsequent development. A dome shaped cell is cut off from the apex of this mother cell by the formation of a transverse septum about one fourth the distance from apex to base (FIGS. 2 and 12). If the term "trichogyne," currently in use in connection with descriptions of the sexual structures in Ascomycetes, may be defined as a cell or series of cells cut off from the

[1] Contribution from Department of Botany, University of Toronto.

[2] The writer is indebted to Miss Margaret Thomson who supplied the Latin diagnosis and to Miss Charlotte Dill for the preparation of the diagrams for figures 1–11.

apex of an ascogonium, then this dome shaped cell may perhaps be properly referred to as a trichogyne. At this stage both cells show a dense granular cytoplasmic content. A slender thread now grows up from the apex of the carpophore just below the ascogonium and is ultimately cut off by a septum close to its point of origin from the stalk cell. This slender thread grows up around the side of the ascogonium and contact is made with the trichogyne at the side (FIGS. 3, 4, 13 and 14). It may grow parallel to the long axis of the ascogonium or slightly oblique to that axis. This thread-like cell, following current usage, may be referred to as an "antheridium."



FIGS. 1–11. *Trichomonascus mycophagus,* diagrams of stages in development. Explanation in text.

Whether or not the initial contact is by a narrowed point at the apex of the antheridial thread could not be determined with certainty. It is clear that in most cases observed the apex of the antheridium appears to be fused with the trichogyne for its whole width and in fact soon begins to broaden out at the apex as will be described below. In some of the cases observed at this stage the contents of the antheridium and trichogyne stain very lightly whereas the ascogonial cell shows deeply stained granular contents. If a true fertilization takes place in this organism by the passage of a nucleus or nuclei from the antheridium through the trichogyne to the

ascogonium it would seem probable that it had already occurred in such cases.

Following this stage what would appear to be a unique and unexpected development takes place. The trichogyne together with the antheridial branch begin to enlarge. This process of enlargement takes place as indicated in figures 4–6, 8–11, 14–17. The antheridial branch is at first a slender thread of equal diameter, about 2 μ, throughout its length. After contact is made with the trichogyne, the apex soon begins to broaden out until the two cells appear to develop as one structure. Figures 4 and 5 show the broadened antheridium in side view and figure 6 in face view. At this stage a papilla begins to develop at the apex of the trichogyne (FIGS. 8, 9 and 15) and gradually develops into a long slender thread-like extension which becomes regularly coiled toward the apex (FIGS. 10 and 11, 16–18). This extension may reach 60–75 μ in length and is about 2 μ in diameter.

At any stage after figure 4 evidence that spores are beginning to develop in the ascogenous cell may be observed. The ascogenous cell thus functions directly as an ascus and does not appear to enlarge appreciably after the stage shown in figure 2. The spores are usually quite well developed at the stages shown in figures 8 and 9. Four spores are usually formed and one commonly finds three of them placed more or less lengthwise and the other above at right angles to the long axis of the fructification. The spores are narrowly ellipsoid, 7–8 $\mu \times 3\,\mu$, with smooth colorless walls. The total length of the mature ascocarp, from the base of the ascus to the tip of the elongated trichogyne, is 70–85 μ. Since the ascogonium does not appear to enlarge appreciably from the time the trichogyne is cut off (FIG. 2) till the ascus is mature, and since the antheridial branch broadens out considerably, the mature ascocarp appears laterally compressed when seen from a position in which the antheridial branch is in face view (FIGS. 6 and 19).

Beginning at the stage shown in figure 8 there appears to be an irregular internal thickening in the wall of the upper part of the antheridial branch and around the base of the elongated trichogyne. This is not shown in the diagrams but is brought out in the microphotographs.

When the antheridial branch fails to make contact with the trichogyne there is no further development of the latter (FIG. 7), which suggests that the cytoplasmic connection which furnishes the food material for the development of the trichogyne is through the antheridial branch rather than through the ascogonium. In such cases however the ascus develops ascospores perhaps parthenogenetically, as is not uncommon among lower ascomycetes that are homothallic. A small amount of cytoplasm is apparently present in the developmental stages of the antheridium and trichogyne (FIGS. 8 and 9) as shown by a light staining of the contents.

DIAGNOSIS

Trichomonascus gen. nov.

Ascocarpa terminalis in cylindrata carpophora nata, ex ascogonio quod pro asco stat et ex antheridio trichogynoque quae alterum cum altero juncta extendunt constata; trichogynum postremo longa cylindrata filo similis extensio, in apice in spiram contorquens.

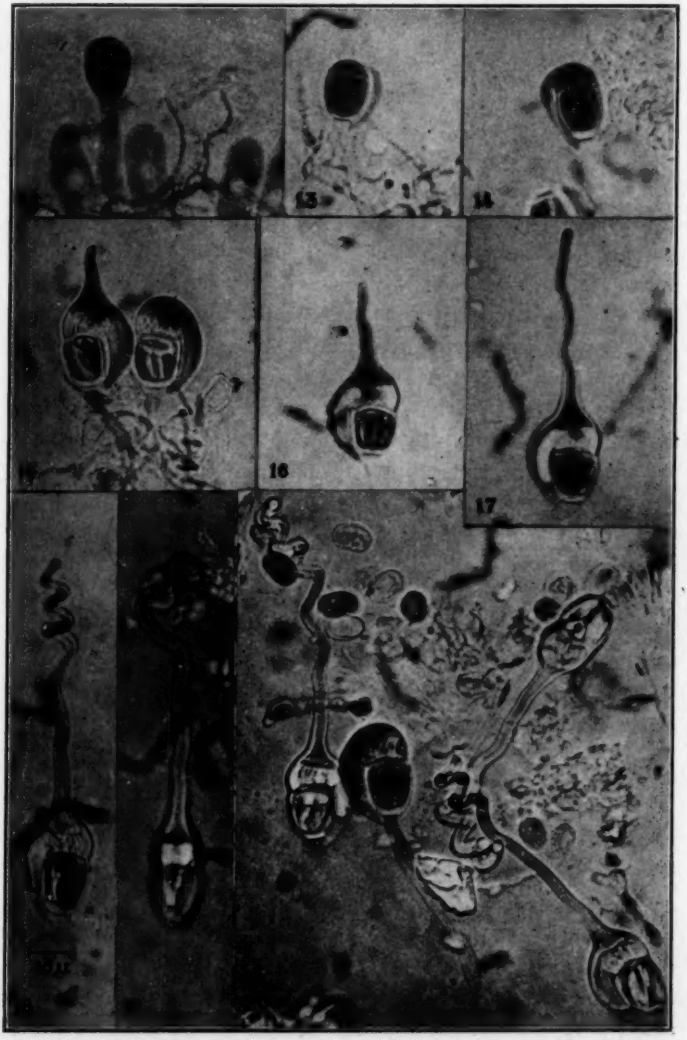
Trichomonascus mycophagus sp. nov.

Ascocarpa terminalis 4–4.5 μ lata in cylindrata carpophora nata; ascogonii materna cella $15 \times 10\ \mu$ ellipsoida; ascogonium, cella ellipsoida, $10 \times 10\ \mu$ magnum, non crescens; trichogynum primo cella hemisphaeroida, ex apice ascogonii cellae maternae abruptum; antheridium, gracilis hypha, $2\ \mu$ latum, ex apice carpophorae infra ascogonium natum, trichogyno se jungens; his junctis, et antheridium apice latius et densium et trichogynum in apice latius, gracile cylindratum filum, $60–75 \times 2\ \mu$ magnum, supra in spiram contortum, fiunt; ascus, ascogonium ipsum non mutatum in quo sunt quattuor ellipsoidae aut subfusoidae, hyalinae, $7–8 \times 3\ \mu$ magnae, muris glabris sporae.

In *Corticio confluente* Fr., in cortice mortuo inferioris rami *Abietis balsameae*, "Bear Island" apud Lacum Timagami invenitur; Aug. 24, 1939. H. S. Jackson TRT *21820*, (**typus**).

DISCUSSION

One of the most intriguing characteristics of Trichomonascus is the subsequent development of the simple dome shaped trichogyne, after it would appear to have served its function, into a structure reminiscent of a more orthodox trichogyne such as occurs in the Florideae and higher Ascomycetes having spermatial (microconidial) fertilization. Shall we dismiss this structural resemblance to a trichogyne as a development having to do with some special



FIGS. 12–20. *Trichomonascus mycophagus*, microphotographs of stages in development. Explanation in text. Extraneous material is of *Corticium confluens*.

method of dissemination of the ascocarp as a whole, or a mechanism having to do with spore dissemination, or is it possible that some phylogenetic significance may be attached to this peculiar development? To those who are not fully convinced of the monophyletic origin of the higher fungi and who consider that it is not impossible that the microconidial or spermatial type of fertilization may be the primitive type of sexuality in the Ascomycetes, Trichomonascus will serve as a new basis for speculation.

While, unfortunately, nothing is known with reference to the nuclear history, if we may judge from the morphology and development as described, Trichomonascus is probably homothallic.

Although I do not wish to enter into a lengthy speculative discussion, a few general remarks on homothallism may not be out of place. I would define true homothallism as that condition among lower organisms in which the full sexual or nuclear cycle may be carried out in a single thallus from an originally uninucleate spore. Such a form is obviously homozygous. Even should gametic union and meiosis occur, the two sets of chromosomes which come together in the zygote would be identical. The occurrence of homothallism in an organism having a highly developed sexual mechanism is strongly suggestive that the condition is derived. The evolutionary development of highly differentiated sexual structures is not to be expected in organisms in which there is no provision for cross fertility. I would therefore consider that in any group showing highly developed sexual structures, or one in which a sexually complete nuclear history occurred in the absence of specialized structures (as for example in the mushrooms), heterothallism is the primitive condition and homothallism derived. It seems reasonable also to suggest that a sexual process involving any method of gametic union would not be expected to become a fixed habit among primitive organisms unless accompanied by a provision for hybridity. This provision for hybridity is the phenomenon we label "heterothallism." The condition which preceded it in the evolutionary development of sexuality in lower organisms was not "homothallism" but sexlessness. Homothallism is a condition of degenerate sexuality. If these suggestions are anywhere near the truth then it follows that great caution

should be exercised in basing discussions of phylogeny or interrelationships on homothallic species.

If this general viewpoint may be accepted as reasonable, then it would seem possible that homothallic forms might be derived from heterothallic lines at various times and at different levels in the progressive evolution of the latter. While such homothallic forms would be derived they may not necessarily be recent. Should such forms be segregated early in the evolutionary development of a group and survive to the present day, being homozygous, they might be expected to change but little and so might retain certain primitive characters.

Possibly Trichomonascus is such a relic form and the elongated coiled structure which ultimately develops from the small dome shaped trichogyne cell may represent a true trichogyne which, in the parent heterothallic form from which it was derived, functioned to receive spermatia. This suggestion would make necessary the assumption, as has been suggested by others, that the sexual process involving an "antheridium" in the Ascomycetes is a substitute one for a spermatial type of sexuality and hence of secondary development.

Many such homothallic forms derived early in the evolutionary history of a group would presumably not survive and the few that remain today, and which have so far been discovered, might be expected to appear as isolated, apparently unrelated forms, difficult to fit into a more or less muddled man-made classification.

RELATIONSHIP

In any case the relationship of Trichomonascus to other simple Ascomycetes is not at all clear. The presence of a trichogyne suggests a relationship higher than the Gymnoascaceae. The fact that the ascogonium functions directly as an ascus suggests a lower position. However, the presence of the trichogyne seems the more important character and for the present Trichomonascus may be assigned tentatively as a simple member of the Aspergillaceae. To make a new family for this organism at this time, in view of our inadequate knowledge of the lower Ascomycetes in general, would seem to serve no useful purpose.

THE DUAL PHENOMENON IN THE DERMATOPHYTES

STEPHEN WILHELM [1]

(WITH 2 FIGURES)

Two factors have been responsible mainly for the illogical species concept applied to the dermatophytes. These are (a) failure to take full cognizance of the phenomenon of variation displayed by most species of dermatophytes in laboratory culture, and (b) the naming of species on the basis of gross cultural characteristics on standard media. The range of variation members of a single imperfect species may show, when subjected to single spore analysis, has been demonstrated fully in only a few cases. In the genus *Fusarium*, Snyder and Hansen (**12**) have shown that the progeny of a single spore culture may show such wide variation as to fall into several species and even sub-sections of the genus as it was formerly constituted. Emmons (**2, 3**) reported on variation of this nature in *Achorion gypseum* and pointed out that the present system of classification permits the raising of cultural variants to species rank.

Prolonged cultivation in the laboratory induces in many species of dermatophytes an abrupt change in type of growth, known to medical mycologists as pleomorphic overgrowth. This pleomorphic growth apparently arises in response to physiological aging, usually appearing first as white, fluffy tufts at the center or edge of a colony. Often it grows over and obscures the original culture. Medical mycologists frequently refer to this phenomenon as a form of degeneration.

[1] The author wishes to express his gratitude to Colonel Hugh W. Mahon, Chief of the Laboratory Service, Fitzsimons General Hospital, Denver, Colorado, for permission to undertake this study while in the Army, and to Drs. H. N. Hansen and William C. Snyder, Division of Plant Pathology, University of California, Berkeley, California, under whose direction the study was continued.

Slight changes in the composition of media and changes in environmental factors, especially light and temperature, also are known to cause pronounced variation in gross colony characteristics and in spore size of dermatophytes and other imperfect fungi (**14, 16, 17**). These types of variation are usually of a transitory nature.

Finally, a species may be composed of a large number of culturally distinct ecological or geographical races. This is true undoubtedly to a greater or lesser degree in all fungi, and has been demonstrated by Hansen (**5**) in *Phoma terrestris* Hans., *Verticillium albo-atrum* Rke. and Bert., *Botrytis cinerea* Pers., and in members of other form genera.

In this study, twelve isolates of *Epidermophyton floccosum* (Harz) Langeron and Milochevitch and four of *Trichophyton gypseum* Bodin [2] were subjected to single spore analysis through five culture series, and the variation recorded by photograph. A slight modification of the technique of Hansen and Smith (**7**) for making single spore cultures was employed. The modification consisted of using potato dextrose agar in the place of Czapek's medium for the dilution plates, and of transplanting the sporelings with a small piece of agar to the slants. All cultures were made on potato dextrose agar slants in 1 × 8 inch test tubes, approximately 20 cc. of medium per tube, and were illuminated with indirect daylight from a large northeast window. For comparative purposes some series were duplicated on potato dextrose peptone and on Sabouraud's glucose agars. Because of the paucity of macroconidia in old cultures of *E. floccosum*, chlamydospores as well as macroconidia were used for the single spore cultures; only single celled chlamydospores, however, were selected for transfer. Potato dextrose agar was found to be a very satisfactory medium for both isolating and maintaining these fungi in culture.

The results of single spore analyses of the isolates mentioned above have shown that these dermatophytes are dual, that is, composed of two distinct constituents associated together in culture,

[2] *Trichophyton gypseum* Bodin has been relegated to synonymy with *T. mentagrophytes* (Robin) Blanchard. In Conant, G., *et al.*, Manual of Clinical Mycology, 1946, W. B. Saunders Co., Phil., but is employed here because of widespread usage.

one producing conidia in abundance but relatively scant mycelium, designated as the *C* or conidial constituent, the other producing fewer conidia and more abundant mycelium, designated as the *M* or mycelial constituent. This is the dual phenomenon which was reported by Hansen in 1938, and shown to occur in many imperfect fungi. The *M* type of these dermatophytes, as in other imperfect fungi, appears to arise as a mutation in old cultures of the *C* type, even though the culture is started from a single conidium. General reference to the work of Hansen, Snyder and Smith (**5, 6, 7, 8, 13**) on the dual phenomenon is made at this time. These authors discuss in considerable detail the occurrence in nature, the biological significance, and bearing on the species concept of this interesting phenomenon.

The sharp contrast in cultural characteristics between *C* and *M* constituents of *T. gypseum* is shown in figure 1, *A*. These distinctions were maintained on potato dextrose peptone, and on Sabouraud's glucose agars, as is shown in figure 1, *B*, but the variation attendant upon changes in medium is striking. According to the system of classification of Conant and his colleagues (**1**), both *C* and *M* constituents of this one isolate of *T. gypseum* on potato dextrose peptone agar would fall into the crateriform group, *C* being raised and *M* sunken in the center. The *M* constituent on Sabouraud's glucose agar answers to the description of *T. interdigitale* Priestley, now considered synonymous with *T. gypseum*, and the *C* constituent on potato dextrose agar conforms to the asteroid type of *T. gypseum*. This evidence supports the kind of synonymy employed by Conant *et al.* but the inadvisability of dividing the genus *Trichophyton* into groups based on cultural characteristics on standard media becomes apparent.

In addition to segregation into distinct *C* and *M* constituents, *E. floccosum* gave rise to many forms culturally intermediate between *C* and *M*. In this fungus, the *C* and *M* types also differ greatly from each other in cultural appearance, the *C* exhibiting the olive green, compact, slow type of growth, the *M*, the white fluffy growth. *C* and *M*, and a number of intermediate types, are shown in figure 2.

These results suggest that in old cultures the mycelium and spores of *E. floccosum* become heterocaryotic with respect to *C*

and *M* nuclei, and that the variation exhibited upon single spore analysis results from chance segregations of these nuclear types in the spores at the time they are formed. Earlier evidence of this phenomenon of heterocaryosis has been presented in the outstanding case of *Botrytis cinerea* (**7**). In *T. gypseum* where cultures were started from single microconidia, which are presumably uninucleate, the chance for nuclear segregation is eliminated largely, and distinct *C* and *M* types only were obtainable. In *E. floccosum*

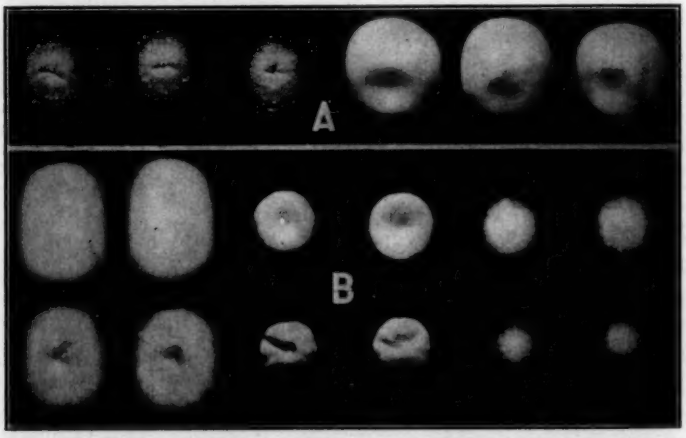


FIG. 1. A. The dual phenomenon in *Trichophyton gypseum*. Left, the *C* constituent; right, the *M* constituent. Cultures are 24 days old on potato dextrose agar. B. *C* and *M* constituents of *Trichophyton gypseum* on Sabouraud's glucose agar, left; potato-dextrose-peptone agar, center; and potato-dextrose agar, right. *C* constituents are in the lower, *M* in the upper row. Cultures are 12 days old on potato dextrose agar.

where cultures were begun by single macroconidia or chlamydospores, the latter presumably multinucleate at the time of formation, distinct *C* and *M* types (homotypes) and intermediate *MC* types (heterotypes) were obtainable. Old cultures of the *MC* heterotypes often produced secondary growth from below the parent colony which in general cultural appearance resembled the parent *C* cultures. Of ninety-eight single spore cultures made from such growths appearing in five strains, forty-eight were typical *C*, forty-seven intermediates, and three typical *M* types. This furnishes

evidence that chance nuclear segregations in heterocaryotic mycelium may account for this phenomenon, considered analogous to sectoring, as well as for the array of variants obtained upon single spore analysis of old cultures.

In one strain of *T. purpureum* Bang [3] available during this study, the *C* type which at one time produced abundant pigment became overgrown completely by the *M* type and was lost while the culture was in storage. The *M* type which was recovered failed to produce the brilliant red pigment. Rather frequent reference is made in the literature to cultures of *T. purpureum* which lose their ability to form pigment (**9**, **15**), and it seems correct in this case to associate loss in ability to form pigment with the *C* and *M* mutation.

In the great majority of cases the *C* constituent is isolated directly from nature, though from chronic lesions it has been possible to recover both *C* and *M* types of *T. gypseum*.

In stock cultures maintained by mass transfer the *C* constituent frequently is lost. This difficulty may be overcome by making transfers from the extreme edge of the colony before it is completely overgrown, or by starting all cultures from single spores, and selecting out the *C* types. *M* types need not be saved, as they arise repeatedly in the *C*. The *C* type, on the other hand, has never been recovered from *M*.

The literature abounds with references to variation in the dermatophytes for which the dual phenomenon, as we know it today, is the more logical explanation. A few of the outstanding cases will be cited in brief.

Sabouraud (**11**) in 1929 referred to the phenomenon of pleomorphism as a definite morphological change occurring in old cultures, involving production of a white downy mycelium which can be isolated from the parent form and which does not revert to the parent form even when inoculated into animals and reisolated. He terms the pleomorphic growth a "fixed mutation."

Emmons (**2**) in 1931 showed that "pleomorphic mycelium" would arise from monospore cultures of both micro and macroconidia of *Achorion gypseum* and that monospore cultures from the pleomorphic growth yielded exactly similar pleomorphic myce-

[3] Relegated to synonymy with *T. rubrum* (Castellani) Sabouraud (*ibid.*) but employed here because of widespread usage.

lium. He states "just how and where this change takes place, is not clear."

Gregory (**4**) considers this pleomorphism an example of the irrevocable mutations or saltations so common in many fungi, rather than a process of gradual degeneration.

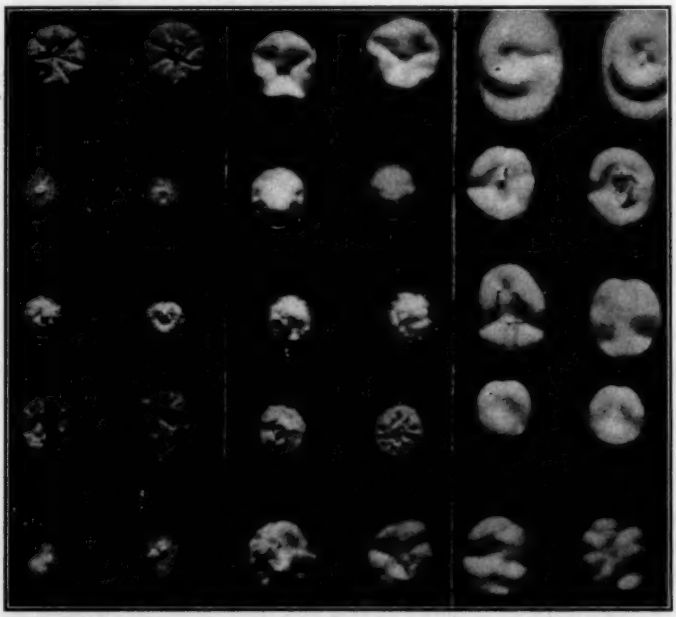


FIG. 2. The dual phenomenon in *Epidermophyton floccosum*, 5 races represented. Left *C* homotypes, center *MC* heterotypes, right *M* homotypes. Cultures 24 days old on potato dextrose agar.

Lewis and Hopper (**9**) state that with repeated subcultures of occasional strains of some fungi such as *Trichophyton purpureum*, pigment fails to develop in the substrate. They state further that this change is limited to a few strains which have been transferred many times, and that there is a considerable lessening of pigment with the appearance of the pleomorphic overgrowth.

Spring (**15**) also mentions loss of red coloration of the medium upon single sporing of *T. purpureum*. In her single spore culture

studies of *T. interdigitale* she obtained two types, one of which was "highly pleomorphic," and one which retained the original yellow powderiness of the parent culture. In her cross planting studies of a number of representatives of these two types, she obtained colonies which fell into three distinct groups, namely (a) those in which the yellow powderiness persisted, (b) intermediates, in which incipient craters and powderiness were nearly overgrown with a white growth, and (c) those composed entirely of white pleomorphic growth. In the light of the dual phenomenon these three groups are interpreted as follows: group (a) planting of two spores of the *C* type together, group (b) planting of one spore of the *C* and one of the *M* type together, group (c) planting of two spores of the *M* type together. Thus instead of setting forth evidence in favor of heterothallism, as was her intention, Spring presented ample proof of the dual nature of these dermatophytes.

The normal and pleomorphic forms of *T. mentagrophytes* pictured by Robbins and McVeigh (**10**) may be interpreted respectively as *C* and *M* types.

SUMMARY AND CONCLUSIONS

1. *Trichophyton gypseum* and *Epidermophyton floccosum* are dual fungi, *i.e.*, composed of two distinct constituents associated together in culture, one producing conidia in abundance but relatively scant mycelium, designated as the *C* or conidial constituent, the other producing fewer conidia and more abundant mycelium, designated as the *M* or mycelial constituent.

2. The *M* constituent arises as a mutation in old cultures of the *C* type even though the culture is started from a single conidium. It appears to be genetically stable.

3. In the two species studied, and probably in *T. purpureum* as well, the pleomorphic overgrowth which appears in old cultures resembles the *M* constituent of these fungi.

4. Chance segregation of *M* and *C* nuclei at the time spores are formed on heterocaryotic mycelium of *E. floccosum* provides a mechanism for explaining the variation exhibited upon single spore analysis of old cultures.

5. Similarly, nuclear segregation also appears to be responsible for sectoring.

6. Members of a species may represent culturally distinct races which probably correspond to ecological or geographical variants.

7. In old stock cultures maintained by mass transfer, the *C* type frequently is lost due to rapid overgrowth of the *M* constituent once it appears.

8. The literature abounds with references to variation in the dermatophytes for which the dual phenomenon seems to be a logical interpretation.

9. The naming of species on the basis of gross cultural characteristics on standard media is untenable and results in confusion.

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ADDITIONAL NOTES ON THE GENUS LEUCOPAXILLUS

ROLF SINGER AND ALEXANDER H. SMITH

(WITH 3 FIGURES)

Since the time our monograph on the genus appeared some additional data have accumulated which it appears desirable to publish. Resumption of exchange of material between this country and Sweden made it possible to check upon the Leucopaxilli of the Riksmuseet at Stockholm. Material of a new species, near *L. giganteus,* a new variety of *L. albissimus,* and excellent fresh material of *L. pulcherrimus* was also obtained. In addition Murrill described *Clitocybe Rappiana* from Florida, the type of which is very similar to *L. gracillimus* S. & S. (see Mycologia **36**: 553. 1944).

As for the material received from Stockholm, we did not find anything that would not confirm the arrangement as made in our monograph (Pap. Mich. Acad. Sci. **28**: 85–132. 1943). The majority of the specimens merely added some items to the list of material studied, and gave the forms of *L. amarus* some European representatives, which was to be expected since the extreme form, f. *alboalutaceus* (F. H. Møller, apud Lange) S. & S., was originally described from Denmark. The chief interest of the Swedish material centered around the specimens, type and co-type as well as other authentic material, of *L. rhodoleucus* (Rom.) Kühner, which had been interpreted in two different ways. We had previously decided to consider Maire's opinion in regard to this fungus as the one most likely to be correct, in contrast to Bresadola's note, both evidently made after a study of type material. All that needed to be done was to check the spores with Melzer's reagent; if the spores were amyloid, Maire's disposition of the fungus was correct, if not, the fungus would go in the genus *Rhodopaxillus* as suggested, or rather implied, by Bresadola. The type as well as all the other material proved to have strongly amy-

loid spores and this fully justified the arrangement made by Maire and later by us.

The following presentation is made in accordance with the order in which the species are treated in our monograph.

SECTION I: ASPROPAXILLI (Maire) S. & S.

Leucopaxillus septentrionalis sp. nov. FIGS. 1–3

Pileo (7)10–20(25) cm. lato, primum convexo, margine involuto, dein applanato vel disco subdepresso, demum late depresso numquam abrupte nec profunde depresso, sicco impolitoque, margine subtomentoso, disco glabro at saepe fissulo vel diffracto, numquam albo sed griseo vel avellaneo, aequaliter sordide alutaceo-grisello statu juvenili, interdum aquose-scrobiculato; carne crassa, albida; odore subspermatico, dein pungente; sapore ingrato; lamellis adnexis, dente decurrentibus, angustis (4–7 mm. latis), confertissimis, lamellulis postice rotundatis intermixtis, nullis vel paucis furcatis, separabilibus, saepe crispis et pallide cremeis in junioribus, demum alutaceo-tinctis; stipite brevi crassoque, 5–9 × 2.5–6 cm., solido, aequali vel subaequali, intus albido, dein sordido, extus carneo-alutaceo, impolito, interdum ad apicem subtomentoso, albo-mycelioso ad basin, demum sordide alutaceo saepeque obscurius tincto quam pileus, saepe glabrescente, colore tactu obscurato, humectando cinnamomeo-alutaceo; sporis 6.5–8.4 × 4–5 μ, levibus, amyloideis; cystidiis ad later aciemque lamellarum nullis; strato cuticulari ex hyphis subintertextis angustis consistente; hyphis omnibus fibuligeris. Caespitose vel gregario sub *Pinu ponderosa;* Bear Springs, Mt. Hood National Forest, Ore. et Don Valley, Toronto, Ontario, Canada.

Pileus (7)10–20(25) cm. broad, at first obtuse or convex, with an inrolled margin, soon expanded to plane or the disc shallowly depressed, on further expansion becoming broadly depressed with a spreading to wavy and often lobed or sinuate margin, at times very irregular, never deeply or sharply depressed, margin remaining inrolled for a long time (long after it has become uplifted), surface—when not rain-soaked—dry and unpolished and with a feel like that of kid, margin unpolished to subtomentose, disc typically glabrous but often irregularly cracked and cuticle at times ruptured into scales of various types—concentric or diffracted, color never truly white or whitish, when wet dull grayish to near "avellaneous," buttons more or less sordid alutaceous-gray over all, watery spotlike depressions present on a few caps; flesh thick in disc (up to 2 cm.), tapered evenly to margin, whitish, unchanging, odor strong and subspermatic when specimens were first collected, later pungent, taste fairly strong and disagreeable; lamellae shallowly adnexed with a short decurrent tooth down apex of stipe, narrow (4–7 mm.), crowded, many lamellulae present and their

FIG. 1.

inner extremities typically rounded, in some caps many gills forked near stipe but in others very few forked, readily separable, often crisped and pale cream color when young, in age flushed alutaceous, edges uneven, stipe short and thick, 5–9 cm. long, 2.5–6 cm. thick, solid, equal or slightly pinched off at base, whitish within when young but sordid in age, surface near "pinkish buff" and unpolished to subtomentose above, with whitish mycelium at base, no conspicuous rhizomorphs or moldy areas in surrounding debris, in age sordid alutaceous and often darker than the cap, often glabrescent, color change progressing from base upward and accentuated by handling or rubbing the surface or if stipe becomes wet, in undamaged specimens usually near "cinnamon buff."

Spores distinctly amyloid, smooth, 6.5–8.5(9) × 4–5 μ, subovoid to narrowly ellipsoid, with an oblique inconspicuous apiculus; basidia four-spored, narrowly clavate, 26–32(38) × 7–9 μ, hyaline but with oil globules as seen revived in KOH; pleurocystidia and cheilocystidia none seen; gill trama of interwoven thin-walled hyphae (6)8–17 μ in diam., clamp connections present; pileus trama with a thin cuticle of narrow (3–6 μ) somewhat interwoven, appressed hyphae, beneath it the hyphae intricately interwoven and 8–18 μ in diam., clamp connections present.

Habit, habitat and distribution. Cespitose-gregarious in large fairy rings under *Pinus ponderosa,* Bear Springs, Mt. Hood National Forest, Ore. The collection was found by Wm. B. Gruber, and consisted of several large rings each containing over a hundred carpophores. The type, Smith no. *24982,* was selected from one of the arcs. So far the species is known only from the type locality and one collection from Ontario (see observations).

Observations. The American collection reported by us under the name *L. lepistoides* is referable to *L. septentrionalis. L. lepistoides* is described as having greenish gray watery spots on the cap, stipe blue within at the base, and a white pileus at first, all characters definitely not possessed by *L. septentrionalis.* In addition, the latter is characterized by the manner in which the stipe darkens after handling or when water-soaked, and by a different habitat. The consistently narrow lamellae in even the largest pilei may also be distinctive. The two species, however, are similar in the manner in which the gills are attached to the stipe and in stature.

FIG. 2.

SECTION II: EU-LEUCOPAXILLUS

Leucopaxillus albissimus var. **monticola** var. nov.

Pileo 5–10 cm. lato, convexo, margine primum involuto pubescenteque, dein convexulo vel applanato, sicco, opaco, glabro, dein minute maculoso-squamuloso et conspicue areolato-rimoso Jove sicco, centro pallide cremeo-alutaceo, margine albido, carne admodum crasso firmoque, odore aromatico, sapore mitissimo; lamellis albis, desiccatione vix discoloratis, arcuatis, mox decurrentibus, angustis, confertissimis, furcatis; stipite 30–99 × 20–30 mm., clavato, saepe aggregato, solido, apice tomentoso-fibrilloso, albo vel pallide cremeo, exsiccando dealbato; mycelio basali albo, copioso; sporis 6.5–8 × 4.5–5 μ, amyloideis, sparse verruculosis; pleurocystidiis (prope aciem paucis) cheilocystidiisque flexuosis, hyalinis, 34–46 × 3–5 μ; subhymenio tenui, ramoso; hyphis cuticularibus intertextis et multis hyphis erectis e strato illo projicientibus, 20–50 × 4–5 μ, fibuligeris. Caespitose sub arboribus frondosis et coniferis. Payette Lake, Idaho; Sequoia National Park, California, et Pinkham Notch, Massachusetts, U. S. A.

Pileus 5–10 cm. broad, convex with an inrolled pubescent margin at first, becoming broadly convex to plane, surface dry and unpolished, glabrous at first but soon developing minute spot-like scales and in addition becoming conspicuously areolate-cracked in dry weather, central portion pale creamy tan (near "cinnamon buff" but paler), whitish toward the margin; flesh very thick and firm, white, unchanging, not readily attacked by insect larvae, odor when fresh strong and aromatic, pleasant, when dried odor distinctive and somewhat disagreeable, taste perfectly mild; lamellae white, hardly discoloring in drying, arcuate to truly decurrent, narrow, crowded, many forked, thin and readily breaking transversely, edges even to slightly floccose; stipe 3–9 cm. long, 2–3 cm. thick at apex, clavate, solid, hard, surface unpolished and tomentose-fibrillose to apex, sometimes minutely scurfy, white or tinged pale cream color, drying whitish, several often fused together at the base, with a copious white basal mycelium penetrating through the duff for some distance.

Spores 6.5–8 × 4.5–5.5 μ, broadly ellipsoid, strongly amyloid, with small scattered warts (at times appearing almost smooth); basidia four-spored, 36–42 × 8–9.5 μ, clavate; pleurocystidia rare and found mostly near the gill edge, 34–46 × 3–5 μ, flexuous, hyaline; cheilocystidia very abundant to scattered, similar to pleurocystidia, gill trama subregular, very compact, hyaline, the hyphae 3–6 μ in diam., subhymenium thin and much branched; pileus trama with a cuticle of interwoven hyphae from which numerous hyphae 20–50 μ long and 4–6 μ in diam. project, their apices usually rounded, clamp connections at cross walls (the upright hyphae

almost forming a turf), trama beneath the cuticle of very compactly interwoven hyphae.

Habit, habitat and distribution. Cespitose under conifers and hardwoods. The type, Wm. B. Gruber *P-27*, was collected at Payette Lakes, Idaho, August, 1943, under *Pinus ponderosa*.

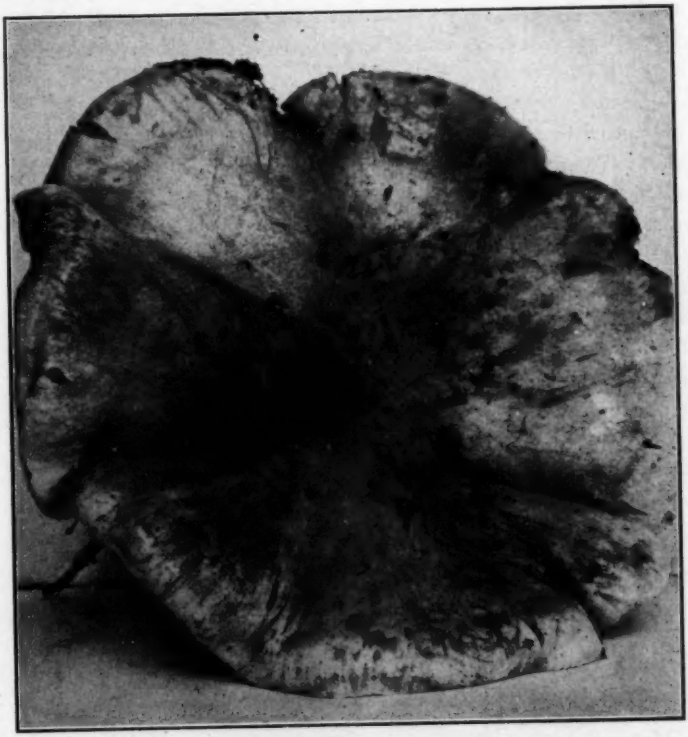

FIG. 3.

The description has been drawn entirely from the type collection. Material identified as this variety was collected by Sam Pusateri, of the National Park Service, at Sequoia National Park, Calif., Nov. 1945 (Pusateri no. *68*). The senior author found it under beech at Pinkham Notch, White Mts., New Hampshire (Singer *WM43*), August 7, 1945.

Observations. This variety could be referred to var. *piceinus* were it not for the mild taste, and it might possibly be referred to var. *paradoxus* if one were to disregard the abundant cheilocystidia. It serves well to bring into focus the evolutionary tendencies within the species, which we emphasized in our monograph. Var. *monticola*, as represented by the type, showed a pronounced tendency for the gills to fork, but not much emphasis should be given to this character until a large series of collections have established it as constant.

Pusateri's collection, from under *Libocedrus decurrens*, is placed here provisionally since neither of us has seen fresh material. Mr. Pusateri's comments are as follows: "Ground covered with snow (12 inches deep) except under trees—one cluster weighed 10 lbs.—several such clusters within a few feet. Temperature below 32 in this locality for past six weeks." The elevation was approximately 4500 ft. The specimens dried well and show no indication of frost damage. If his material, as seems to be the case as far as the microscopic characters go, actually belongs in this variety, the dimensions of the fruiting bodies as well as of the clusters will have to be revised upward.

LEUCOPAXILLUS ALBISSIMUS var. TYPICUS

Material studied: An excellent collection was found in a mixed forest near Rhododendron, Ore., Oct. 24, 1944, by Wm. B. Gruber and the junior author (Smith, *20172*). The filamentose, flexuous cheilocystidia are fairly abundant on these fruiting bodies.

LEUCOPAXILLUS ALBISSIMUS var. PARADOXUS (Cost. & Duf.) S. & S.

Material studied: We can now add two specimens from Sweden, south of Kristianstad (no. *10194*), coll. P. Tufveson, which is preserved in the Romell Herbarium (Riksmuseet) with the indication "*Lepista amara* Pat. t. 618," [1] and another specimen collected in Stockholm, Ladugärdsgarde, by Margareta Akerhielm, both good

[1] It is true that Patouillard's interpretation of *Agaricus amarus* A. & S. ex Fr. appears to be the same as *L. albissimus* var. *paradoxus* rather than *L. amarus*. However, his name is merely erroneous and cannot be accepted.

specimens and photographs, conform with our description (*l.c.* p. 112). We can also add another specimen from France, Noisy-le-Sec, coll. L. Joachim and incorporated in the Romell Herbarium.

LEUCOPAXILLUS PULCHERRIMUS (Pk.) S. & S.

Pileus 5–10 cm. broad, plane or nearly so and with an incurved margin at first, becoming shallowly depressed to somewhat funnel-shaped or disc merely flat and margin uplifted, surface moist and hygrophanous at maturity, when young moist but also unpolished, "amber yellow" fading to "massicot yellow," margin not striate when moist but frequently incised or wavy at maturity; flesh soft and fragile, watery yellowish, fading to whitish, no odor or taste, no color change when bruised; lamellae "cartridge buff" with a "pinkish buff" reflection, decurrent, close, narrow (3–5 mm.), very few anastomosing on stipe, edges even; stipe short, 2–5 cm. long, 1–2 cm. thick, enlarged upward, solid, pallid, yellow within, surface yellowish and unpolished, with white mycelium around the base binding much debris together; spores white in deposits.

The microscopic characters are as we described them previously for the type. Josserand (Bull. Soc. Myc. Fr. **56**: 31, fig. 117) has found this species in France and has given an excellent drawing of the spore. The description of the fruiting bodies given above was drawn from specimens collected under beech near the edge of a swamp, Milford, Mich., Oct. 4, 1945, Smith no. *21031*. The species appears to be very rare.

LEUCOPAXILLUS LATERARIUS (Pk.) S. & S.

Material studied: Dried material from Peabody, Mass., Oct. 1911, coll. R. B. Mackintosh. This was determined as *Clitocybe gigantea* by W. G. Farlow, and appears to be the first indication of this species in Massachusetts. During the summer of 1946 *L. laterarius* was very abundant in the vicinity of the University of Michigan's Biological Station at Douglas Lake, Michigan and it was also found at Cross Village, Smith nos. *21574* and *21695*. Fresh material from Mountain Lake, Va., was collected by the senior author July 22, 1946, under oak on leaf-mold. In this collection the pileus was whitish and the lamellae pale pink; the taste was very bitter, and the odor aromatic—resembling fresh

sauerkraut. The spore print is pure white. This is apparently the first record of this species from Virginia.

LEUCOPAXILLUS RHODOLEUCUS (Romell) Kühner

The description of the Swedish plant and the description given by Maire, as copied in our monograph (*l.c.* p. 119), refer to the same fungus and have to be combined. Our personal examination of the microscopical characters follows:

Spores 7.5–8.3 × 5–6 μ, hyaline, warty, amyloid, thin-walled, without a smooth disc above the hilar end, short-ellipsoid; basidia 20–43 × 8.2 μ, four-spored; cystidia and cheilocystidia none; subhymenium about 15 μ thick, appearing thicker because of the septate base of many basidia (the short ones), ramose; trama regular, consisting of interwoven, densely packed, elongate hyaline hyphae; all hyphae with clamp connections.

Note: The figures show cream colored lamellae; the red tints shown in some (FIGS. *B* and *C* of the original paintings by Romell) are a pale "orange vinaceous" of Ridgway.

LEUCOPAXILLUS TRICOLOR (Pk.) Kühner

Material studied: Abundant material of this fungus was found in the vicinity of the University of Michigan's Biological Station during the summer of 1946 (Smith nos. *21806, 22137;* also at Harbor Springs, Smith no. *22080*). It was first found on July 22 on Grape Vine Point and was not infrequent in the hardwood areas throughout August. To our knowledge this is the first time the species has been encountered as a common element in the agaric flora of a local area. In coll. *21806* the carpophores were subcespitose.

LEUCOPAXILLUS AMARUS (A. & S. ex Fr.) Kühner, f. typicus

Material studied: Both sf. *major* and sf. *minor* are represented in Swedish material from Experimentalfältet, Stockholm; from Stockholm toward "Skuggan"; Upsala, Upland; Stockholmstrakten; Stockholms-Näs and Saltsjö-Järla, Södermanland collected by Romell himself, others by Kugelberg, Bengt Cortin and H. v. Post.

F. VULPECULUS (Kalchbr.) S. & S.

There is a specimen from spruce woods, collected by Post in Stockholm, Ugglevisskogen, Nov. 10, 1894, with a picture, and also notes in Swedish (no. *9279*). Romell notes that this is *"C. amara* but taste not *bitter."* The cheilocystidia are drawn as they are in f. *typicus,* not as indicated by Kühner, but the senior author was unable to check on this point since the cheilocystidia are not well preserved in this specimen.

F. BICOLOR (Murr.) S. & S.

Material from Stockholm, Djurgarden, Djurgardsbrunn, H. Kugelberg, Nov. 10, 1889, determined (probably by Romell) as *Clitocybe amara,* is obviously this form, which is new for Europe. There is no incrusting pigment on the hyphae of the cuticle, and the colors are exactly those observed in American material.

LEUCOPAXILLUS GRACILLIMUS S. & S.

The lamellae of *Clitocybe Rappiana* Murr. (Proc. Fla. Acad. Sci. **7**: 108. 1944, published 1945) are exactly as crowded as those of *L. gracillimus.* There is no doubt but that this Floridan species is closely related to the fungus from Brazil. It has been pointed out before that the fungus described by Murrill is larger than *L. gracillimus.* As to color, if the term latericious as used by Murrill is approximately equal to the term sanguineus of Rick, the Florida agaric may be considered to be a larger geographical race of *L. gracillimus.* However, the color of the dried specimens is not redder than that of *L. amarus* in dried caps. If the color of *C. Rappiana* should turn out to be the same as that of *L. amarus* and *L. gracillimus* should have a redder color when fresh, then we believe that it might be best to consider *C. Rappiana* as an autonomous form intermediate between *L. amarus* and *L. gracillimus.* Since *L. amarus* f. *gracilis* is also somewhat intermediate—though in another sense—between these two species, we have also compared f. *gracilis* with *C. Rappiana.* However, we were not satisfied as to their identity.

Under these circumstances it appears that *C. Rappiana,* though not identical with the type form of *L. gracillimus,* is too similar to it in fundamental characters to warrant its being maintained as an autonomous species. We know its approximate position in the classification of *Leucopaxillus,* but hesitate to transfer the name to this genus until studies of fresh material have clarified its status further.

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SELENOPHOMA ON GRASSES, III [1]

RODERICK SPRAGUE [2] AND A. G. JOHNSON [3]

Frandsen (**5**) in 1943 erected the genus *Lunospora* apparently with the same concept as the genus *Selenophoma* Maire (**11**), an earlier name taken up by Sprague and A. G. Johnson (**21, 22**). Frandsen proposed ten species of *Lunospora*. The type species, *L. oxyspora* (Penz. and Sacc.) Frandsen, based on *Septoria oxyspora* Penz. and Sacc., we consider a synonym of *S. donacis* (Pass.) Sprague and A. G. Johnson (**21**).

Frandsen proposed *Lunospora curva* (Karst.) Frandsen based on *Septoria curva* Karst. (**8**). Petrak, in 1940 (**15**, p. 239), assigned this fungus to *Selenophoma curva* (Karst.) Petrak. The writers agree with Petrak that this species belongs in the genus *Selenophoma* but prefer to place it in *S. donacis*. This species has boomerang-shape or falcate spores, 18–30 × 2–4 μ (**13, 20**). Karsten (**8**) described *Septoria curva* as having spores 14–20 × 3.5–4.5 μ. Saccardo (**16**) recorded the same measurements whereas Grove (**7**) gives slightly longer and narrower dimensions, 14–25 × 3–4 μ. Petrak (**15**, p. 239) gives the spore measurements as 10–16 × 2.5–3.5 μ. Material of Petrak's Flora Bohemiae et Moraviae exs., II ser., no. *540* on *Phragmites communis* has spores 14–19 × 2.5–3.1 μ, with some uniseptate spores. The uniseptate spores are somewhat lunate rather than boomerang-shape as in most material of *S. donacis* on *Arundo* and *Phalaris*. Except for

[1] Coöperative investigations between the Divisions of Cereal Crops and Diseases, Forage Crops and Diseases, and Soils, Fertilizers and Irrigation, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration; and the Nursery Division, Soil Conservation Service, U. S. Department of Agriculture, and the North Dakota and Washington Agricultural Experiment Stations. Published as scientific Paper No. 720, Washington College of Agriculture and Agricultural Experiment Station.

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[3] Principal Pathologist, Division of Cereal Crops and Diseases.

the septa, the spores of this collection resemble rather closely those of *S. donacis* var. *stomaticola* (Bäuml.) Sprague and A. G. Johnson (**22**). The specimens were collected May 8, 1912, and, therefore, the spores clearly had overwintered on the old culms. The senior author has examined similar material on Petrak's Fungi Polonici exs. no. *512* collected May 12, 1917 on old culms. In August, 1944, he also collected scanty leaf spot material on *Phragmites communis* Trin. on the south shore of Devil's Lake near Ft. Totten, N. Dak., in which spores were non-septate, 13–20 × 2.5–3.2 μ, borne in lesions having the characteristic, narrow, pale-tinted border produced by *S. donacis* on most hosts.

Grove (**7**) classifies *Septoria curva* as *Rhabdospora curva* (Karst.) Allesch., Allescher (**1**) having placed it in the latter genus in 1901. Grove mentions that he considered the fungus close to *Septoria oxyspora,* which we regard as a synonym of *Selenophoma donacis.* Furthermore, Sydow's Mycotheca Germanica No. *1667,* collected on dry culms of *Phragmites communis,* May 13, 1917, is labelled *R. curva,* which we prefer to consider a synonym of *S. donacis.*

Selenophoma is fundamentally a genus with non-septate spores. Septa, when they occur, appear in spores that have been mature for a long time, often after they have passed through a winter on dead host parts. *Phragmites communis* is a particularly lush host for saprophytic fungi as indicated by the confusing array of saprophytic, pycnidial forms that have been described on it. With everything considered, therefore, the presence of a few uniseptate spores, especially in overwintered material on *P. communis,* is not sufficient reason to exclude *Septoria curva* from the previously described *Selenophoma donacis.* Incidentally, Petrak (**15**, p. 238), in his recent discussion of *Septoria curva,* states that the spores in the material with which he worked were non-septate. The senior author has seen septate spores in overwintered material of *S. donacis* var. *stomaticola* on *Elymus glaucus* Buckl. collected by him west of Skamania, Wash. (O.S.C. *768*). The spores in this material were 13–20 × 2.0–3.3 μ, borne in brown pycnidia 110–160 μ in diameter with typically small subcarbonaceous cellular structure. At one time the senior author assigned this to *Septoria curva,* but he now feels that the differences in the pycnidia and spores are due to over-

wintering rather than to any fundamental differences in morphology. The type of *Phyllosticta stomaticola* Bäuml., which is the basis for *S. donacis* var. *stomaticola,* is itself based on winter pycnidia. In the original description, however, the spores were not described as being septate. In general, in practically all material on all hosts except *P. communis,* the spores are non-septate. Diedicke described (**4**, p. 531) and illustrated (**4**, p. 432, FIG. 27) the spores of *Septoria curva* as non-septate, but as noted by Grove (**7**), he (**4**, p. 532) commented that they seem finally to become unequally triseptate. Likewise Migula (**12**, p. 447, pl. 57, FIG. 18) described and illustrated the spores of this fungus as non-septate.

Demidova (**3**, p. 152) described and illustrated 7-septate, falcate spores for *Septoria falcispora* Demidova on *Briza media, Festuca pratensis, Poa pratensis,* and *Secale cereale. Septoria falcispora* differs widely from *Selenophoma,* however, and possibly may belong in the genus *Phaeoseptoria* (**18**). The small, hyaline, non-septate, falcate spores described and illustrated by Demidova (**3**, p. 152, FIG. 24) as *Septoria secalina* Sacc. on *Secale cereale* are microspores of *Septoria secalis* Prill. and Del. (**19**, p. 84). Those referred to by her (**3**, p. 152, FIG. 23) as *S. cristati* Hollòs on *Triticum vulgare* are microspores of *S. tritici* Rob. (**19**, p. 16, FIG. 1, A, K, N). Those referred to by her (**3**, p. 152, FIG. 25) as *S. secalina* Sacc. on *Agrostis alba* are microspores probably of *S. calamagrostidis* (Lib.) Sacc. or *S. triseti* Speg. (**19**, p. 95). Therefore, none of these belongs in the genus *Selenophoma.*

The following additional species referred to by Frandsen (**5**) are: *Lunospora culmifida* (Lind) Frandsen, *L. suboxyspora* (Lobik) Frandsen, *L. culmorum* (Grove) Frandsen, and *L. lunata* (Grove) Frandsen all belong in *Selenophoma donacis* var. *stomaticola.* Likewise Frandsen's *L. baldingerae,* which he described as new, is indistinguishable from *S. donacis* on *Arundo donax* L. and is assigned to that species (**20**). *S. donacis* is common on *Phalaris* (*Baldingera*)*arundinacea* L. in the western United States.

Frandsen (**5**, p. 74) also described *Lunospora avenae* as new on *Avena elatior,* with spores 15–17 × 2.5–3.5 μ. *A. elatior* is the type host for *Phyllosticta stomaticola* Bäuml. on which *Selenophoma donacis* var. *stomaticola* is based. Although the spores are slightly wider than those described for *S. donacis* var. *stomati-*

cola, the writers feel that *L. avenae* Frandsen likewise can be assigned to *S. donacis* var. *stomaticola.* Likewise, also, *Lunospora penniseti* (Trott.) Frandsen (**5**, p. *72*) apparently should be referred to *Sel. donacis* var. *stomaticola.*

Lunospora bromigena (Sacc.) Frandsen (**5**, p. *72*) clearly should be referred to *Selenophoma bromigena* (Sacc.) Sprague and A. G. Johnson (**21**).

According to the above, therefore, the pertinent synonymy would be as follows:

SELENOPHOMA DONACIS (Pass.) Sprague and A. G. Johnson, 1940 (**21**)

Syn.—*Septoria donacis* Pass., 1878 (**13, 23**)
Septoria oxyspora Penz. and Sacc., 1884 (**14**)
Septoria curva Karst., 1887 (**8**)
Rhabdospora curva Allesch., 1901 (**1**)
Selenophoma curva Petrak, 1940 (**15**)
Lunospora curva Frandsen, 1943 (**5**)
L. oxyspora Frandsen, 1943 (**5**)
L. baldingerae Frandsen, 1943 (**5**)

SELENOPHOMA DONACIS var. STOMATICOLA (Bäuml.) Sprague and A. G. Johnson, 1945 (**22**)

Syn.—*Phyllosticta stomaticola* Bäuml., 1890 (**2**)
Septoria culmifida Lind, 1907 (**9**)
S. oxyspora var. *culmorum* Grove, 1916 (**6**)
S. oxyspora var. *penniseti* Trott., 1916 (**24**)
S. suboxyspora Lobik, 1928 (**10**)
S. lunata Grove, 1935 (**7**)
Lunospora culmifida Frandsen, 1943 (**5**)
L. culmorum Frandsen, 1943 (**5**)
L. suboxyspora Frandsen, 1943 (**5**)
L. lunata Frandsen, 1943 (**5**)
L. penniseti Frandsen, 1943 (**5**)
L. avenae Frandsen, 1943 (**5**)

SELENOPHOMA BROMIGENA (Sacc.) Sprague and A. G. Johnson, 1940 (21)

Syn.—*Septoria bromigena* Sacc., 1915 (17)
Lunospora bromigena Frandsen, 1943 (5)

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NOTES AND BRIEF ARTICLES

Seaverinia Geranii

This discomycete has been reported heretofore from only four stations, Van Cortlandt Park (the type locality) and Bronx Park, both in New York City, one in Wisconsin and one in the Cayuga Lake Basin in the McLean Bogs near McLean, New York. Two new stations were found in the Basin during the spring of 1947, one at Michigan Hollow near Danby, and the other in Coy Glen near Ithaca. In each case ascospore shootings recovered the characteristic imperfect stage recently described and figured by Seaver (Mycologia **39**: 113–119. 1947) and confirmed the determination as *Seaverinia Geranii* (Seaver and Horne) Whetzel. The collections have been filed in the Cornell Plant Pathology Herbarium under the accession numbers 36929 and 36931.—Richard P. Korf.

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ZIEGLER, ARTHUR WILLIAM, Instructor in Botany, University of North Carolina, *Box 602, Chapel Hill, N. C.* (Saprolegniaceae.)

ZIFFER, JACK, Research Fermentation Chemist, *A. E. Staley Co., Decatur, Ill.* (Fermentation research; antibiotic research; microbial enzymes; biochemistry of microörganisms; utilization of agricultural and industrial by-products.)

ZUCK, DR. ROBERT K., *Department of Botany, Drew University, Madison, N. J.*

ZUNDEL, DR. GEORGE LORENZO INGRAM, Associate Professor, Agricultural Extension, *Pennsylvania State College, State College, Pa.* (Smuts.)

DECEASED MEMBERS

R. A. HARPER
RALPH JUSTO-PRATS
D. H. LINDER
L. O. OVERHOLTS

CONSTITUTION AND BY-LAWS

CONSTITUTION

Art. 1. Name. The Society shall be known as the Mycological Society of America.

Art. 2. Membership.

(1) The Society shall consist of members and may include life members, patrons, honorary members, and corresponding members.

(2) Charter membership in the Society shall consist of the persons who, after the invitation of the Secretary, joined before or during the formal organization of the Society at the Atlantic City meetings in 1932.

Art. 3. Dues. The dues for regular members shall be five dollars a year. Any member may become a life member by paying one hundred dollars in one payment, or a patron by paying one thousand dollars, and upon election shall have all the privileges of members. Such funds obtained from life members and patrons shall constitute an endowment fund to be used as may be decided by the Council for the support of mycological publications or projects.

Annual dues of five dollars shall include subscription to the official organ of the Society, and shall be payable in advance on or before December 20. Bills for dues shall be sent to the members in October and it will be necessary to discontinue sending the journal to those whose dues have not been paid by December 20.

Art. 4. Membership and Election of Members.

(1) All persons interested in the study of the fungi shall be eligible to membership.

(2) Members may be elected at any regular meeting of the Society or in the interim between meetings may be elected by the Council. Application for membership must be endorsed by at least one member of the Society.

Art. 5. Officers. The officers of the Society shall consist of a President, Vice-President, and Secretary-Treasurer, whose duties shall be those usually performed by such officers. The President and Vice-President shall serve for one year and the Secretary-Treasurer for three years (or until their successors are elected). Any vacancies occurring in the interim between elections shall be filled by the Council.

The Council shall consist of the President, Vice-President, Secretary-Treasurer, and four Councilors. The Councilors shall be elected, two each year, to serve a term of two years. Two of the councilors shall be from east of the Mississippi (Minnesota is counted as west of the Mississippi) and two west. An individual may not hold two or more positions on the Council at one time.

The Council shall name a Historian to serve for an indeterminate period of years. It shall be the duty of the Historian to accumulate and preserve facts, papers, photographs, and other materials pertinent to a permanent historical record of the Society. The Historian shall not become a member of the Council by virtue of his office as Historian.

Art. 6. Editors and Committees. The editors of the official journal of the Society shall be elected by the Council. The President shall appoint all temporary committees that are to serve during his administration and shall fill all vacancies on standing committees that may occur during his term of office.

Art. 7. Election of Officers. The Secretary-Treasurer shall send to each member of the Society in October a ballot for the nomination of officers. If any nominations are lacking, the Council shall have power to make them. The three candidates for each office receiving the highest number of nominating votes shall be placed upon a final ballot to be sent to each member December 1. Should the nominating votes received by a candidate place him among the highest three for more than one office, his name shall appear on the final ballot for only the highest office. The offices rank in the order given in article 5. Votes shall be mailed to the Secretary-Treasurer and counted by the Council. A plurality vote shall elect.

Art. 8. Meetings. An annual meeting shall be held at such time and place each year as the Council may select (usually in connection with the A.A.A.S. meetings). An additional meeting for informal discussion and the carrying out of collecting forays shall be held in the summer or autumn at a time to be selected by the Council. Additional meetings, including special or local meetings for the presentation of papers or the carrying out of forays, may be arranged by the Council at its discretion.

Art. 9. Divisions. Branch organizations or units within the Society, known as Divisions, may be established on a geographical basis provided formal application, setting forth the reasons for the establishment of the Division, is made to the parent Society and approved by it.

Art. 10. Journal. The Society shall adopt or establish a journal which shall serve the Society as its official organ primarily for the publication of mycological papers by its members, for the publication of abstracts of the papers delivered at the annual or other meetings, and for the publication of the report of the Auditing Committee or of other reports, announcements, and business of the Society.

Art. 11. Amendments. These articles may be amended by a majority vote of the members voting at any regular meeting of the Society, provided that suggested amendments have been brought to the attention of the Council of the Society in time to be sent to all of the members at least one month previous to the meeting.

BY-LAWS

1. Programs. Programs for annual or other meetings shall be arranged by the Council.

2. Papers. Members wishing to present papers at the annual meeting shall submit to the Secretary-Treasurer the substance and conclusions of the papers in a clear and concise abstract of not more than 200 words. These shall be due on or before November 15, and the Secretary-Treasurer shall be authorized to refuse any received after that date. These abstracts will be

edited by the editorial committee of the official journal of the Society for subsequent publication in that organ. Members are urged not to submit titles or abstracts unless they expect to attend the meetings. Except by invitation no member shall offer more than two papers at any one meeting, papers of joint authorship being attributed to the author reading the paper.

3. Associates. Students and others not yet members of the Society may attend meetings and forays in the status of Associates, provided they are recommended to the Council by a member of the Society and pay a fee of one dollar. Such Associates, as they are not members, shall not have the privilege of voting and shall not receive the official journal of the Society, but shall enjoy the other privileges of the meetings and forays including the right to present one paper on the program.

4. Auditing. At each annual meeting the active President shall appoint an auditing committee to audit the accounts of the Society and of its official publication. An audited statement shall be published in the official organ of the Society.

5. Use of the Society's name. Unauthorized use of the name of the Mycological Society of America for advertising or other business ventures is prohibited. The circulation of any unauthorized literature shall be taken as prima facie evidence of the violation of the intent and purpose expressed in this by-law, and the member, after being properly notified, may be expelled from the Society by a majority vote of either the Society at its meetings, or by a majority vote of the Council.

6. These rules may be amended by a majority vote of the members voting at any regular meeting of the Society, provided that suggested amendments have been brought to the attention of the Council of the Society in time to be sent to all the members at least one month previous to the meeting.

CONTRACT WITH THE NEW YORK BOTANICAL GARDEN

The Mycological Society of America hereby adopts *Mycologia* as its official organ on the following terms:

1. *Mycologia* will continue to be published by the New York Botanical Garden, the editorial policies to be determined by an Editorial Board, consisting of a Managing Editor appointed by the New York Botanical Garden, and five Editors elected by the Mycological Society of America. The term of office of the five elected editors will be five years, except that at the start they will be designated to serve one to five years respectively. One editor will be elected annually, thereafter, to fill the place of each retiring editor.

The six members of the Editorial Board will elect an Editor-in-Chief for a term of five years, subject to the approval of the Council of the Society and the Administration of the New York Botanical Garden. He will be eligible for repeated reëlection. Final decision of all questions on editorial policy will be made by him, except that the Managing Editor will have full authority in all matters pertaining to the finances of the journal.

2. All personal subscribers now receiving *Mycologia* may become members of the Mycological Society of America if they so desire. Institutional subscribers to *Mycologia* are not to be regarded as members of the Society.

3. All members of the Mycological Society of America in good standing will receive *Mycologia*. In return the Society will transmit to the New York Botanical Garden, through the Managing Editor, four dollars per year for each such member.

4. The New York Botanical Garden agrees to spend on the publication and distribution of *Mycologia* all funds received from subscriptions, as well as all funds transmitted by the Mycological Society of America. The Garden further agrees to use for these purposes all sums received from the sale of those volumes of the journal which shall be published after this contract is put in force. Earlier volumes remain the property of the New York Botanical Garden. It is understood that the journal will be used by the Garden for exchange purposes as formerly. Should the contract be terminated, it is agreed by the Mycological Society of America that all excess stock of *Mycologia* then on hand will be regarded as the property of the New York Botanical Garden.

5. The New York Botanical Garden reserves the fourth cover page to be used without charge for the advertisement of its publications, including *Mycologia*. The other three cover pages will be used by the Mycological Society of America as it may see fit. All sums collected from paid advertising will be expended on the journal.

6. This contract may be altered at any time by mutual agreement of the New York Botanical Garden and the Mycological Society of America. It may be terminated at the end of any calendar year on six months written notice should it prove unsatisfactory to either party concerned.

7. The contract goes into effect at the beginning of the calendar year 1933.

PAST AND PRESENT OFFICERS

	PRESIDENT		VICE-PRESIDENT
1932	Wm. H. Weston, Jr.	1933	G. W. Martin
1933	C. L. Shear	1934	B. O. Dodge
1934	H. S. Jackson	1935	John Dearness
1935	B. O. Dodge	1936	A. H. R. Buller
1936	H. M. Fitzpatrick	1937	L. O. Overholts
1937	John Dearness	1938	E. B. Mains
1938	L. O. Overholts	1939	D. H. Linder
1939	H. H. Whetzel	1940	E. A. Bessey
1940	D. H. Linder	1941	W. H. Snell
1941	E. A. Bessey	1942	J. N. Couch
1942	E. B. Mains	1943	F. D. Kern
1943	J. N. Couch	1944	N. E. Stevens
1944	G. W. Martin	1945	G. B. Cummins
1945	F. D. Kern	1946	J. A. Stevenson
1946	G. B. Cummins	1947	J. H. Miller
1947	J. A. Stevenson		

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1932–35	H. M. Fitzpatrick
1936–38	D. H. Linder
1939–41	J. N. Couch
1942–44	G. B. Cummins
1945–47	F. K. Sparrow

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1932–33	H. S. Jackson
1933–34	C. R. Orton
1934–35	L. O. Overholts
1935–36	C. L. Shear
1936–37	B. O. Dodge
1937–38	H. M. Fitzpatrick
1938–39	W. H. Weston
1939–40	L. O. Overholts
1940–41	H. H. Whetzel
1941–42	F. D. Kern
1942–43	D. H. Linder
1943	F. D. Heald
1943–44	C. W. Dodge
1943–44	E. B. Mains
1944–45	Lee Bonar
1944–45	J. N. Couch
1945	J. A. Stevenson
1945–46	G. W. Martin
1946	J. H. Miller
1946–47	S. M. Zeller
1946–47	F. D. Kern
1947–48	G. B. Cummins
1947–48	J. C. Gilman

EDITORIAL BOARD OF MYCOLOGIA

1933–45	F. J. Seaver, Managing Editor and Editor-in-Chief
1946–	A. H. Smith, Editor-in-Chief
1946–	F. J. Seaver, Managing Editor

1933	H. M. Fitzpatrick
1933–34	J. A. Stevenson
1933–35	F. A. Wolf
1933–36	G. R. Bisby
1933–37	E. B. Mains
1934–38	G. W. Martin
1935–39	J. A. Stevenson
1936–40	F. A. Wolf
1937–41	J. N. Couch (resigned Dec. 1939)
1940–41	F. K. Sparrow
1938–42	S. M. Zeller
1939–43	H. S. Jackson
1940–44	J. A. Stevenson
1941–45	J. H. Miller
1942–46	J. G. Hopkins
1943–47	A. H. Smith
1944–48	W. W. Ray
1945–49	B. O. Dodge
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1946–50	E. K. Cash
1947–51	N. F. Conant

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REPRESENTATIVES ON THE COUNCIL OF THE A.A.A.S.

W. H. Snell (1947)
W. G. Solheim (1948)

REPRESENTATIVE TO THE NATIONAL RESEARCH COUNCIL

N. E. Stevens (1948)

REPRESENTATIVE TO THE EDITORIAL COMMITTEE, AMERICAN JOURNAL OF BOTANY

Josiah Lowe (1949)

REPRESENTATIVES TO COUNCIL OF UNION OF AMERICAN BIOLOGICAL SOCIETIES

J. S. Karling (1947)
W. L. White (1947)

MYCOLOGICAL SOCIETY OF AMERICA

FINANCIAL STATEMENT

(Jan. 1, 1946–Sept. 30, 1946) [1]

Balance on hand, Dec. 31, 1945:		
Cash	$ 712.40	
Savings account	395.98	
Bonds	840.00	
Total	$1948.38	$1948.38
Receipts:		
Annual dues, back numbers of MYCOLOGIA, reprints	$ 981.86	
Interest, savings account	5.31	
Total	$ 987.17	$ 987.17
Grand total		$2935.55
Expenditures:		
Subscriptions to MYCOLOGIA, back numbers, reprints	$ 787.36	
Printing, addressograph, etc.	156.53	
Letterheads, postage, telephone, etc., for Sec.-Treas.	51.87	
Secretarial assistance	14.63	
Secretary's expenses, St. Louis meetings	69.39	
Letterheads, postage, Editor-in-Chief MYCOLOGIA	53.12	
Editorial assistance	96.00	
Bank charges	1.19	
Total	$1230.09	$1230.09
Balance on hand, Sept. 30, 1946:		
Cash	$ 464.17	
Savings account	401.29	
Bonds	840.00	
Total	$1705.46	$1705.46
Grand total		$2935.55

F. K. SPARROW,
Sec.-Treasurer

Examined and found correct:

(Signed) ARTHUR B. HILLEGAS,
Chairman, Auditing Committee
JOHN EHRLICH, 1-27-47

[1] By vote of the Society at the St. Louis Meeting, the fiscal year was changed to Oct. 1–Sept. 30.

MYCOLOGIA

FINANCIAL STATEMENT

(July 1, 1945–June 30, 1946)

Unexpended reserve		$ 3183.51
Current receipts (joint funds):		
Mycological Society of America	$1719.36	
Subscriptions	2813.74	
Sale of back sets (25–)	775.89	
Contributions for excess pages	203.79	
	$5512.78	
Special funds:		
Sale of back sets (1–24) plus index	$ 711.46	
Interest on Endowment Fund	410.00	
	$1121.46	
Total receipts		$ 6634.24
Total on hand		$ 9817.75
Cost of printing and distribution:		
Six issues	$4063.13	
Reprinting exhausted issues	778.00	
Miscellaneous, postage, etc.	193.86	
	$5034.99	$ 5034.99
Balance		$ 4782.76
Transferred to Endowment Fund		1000.00
Unexpended reserve		$ 3782.76
Endowment Fund		12000.00

The above figures have been officially audited by Price, Waterhouse & Co., and found correct.

(Signed) FRED J. SEAVER,
Managing Editor

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